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THE EXTERNAL ANATOMY OF THE SQUASH BUG, ANASA TRISTIS DE G.*

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INTRODUCTION

In writing this article the chief aim is to endeavor to supply a reference work on the external morphological characters of a typical Heteropterous insect. For this reason the common squash bug has been selected as it is widely distributed, well known as a pest, and is readily obtainable for study.

In order to make the paper as complete as possible the morphologists' and systematists' terms have both been used, except in referring to the wing venation (the systematists' terms being lacking in the fore-wing and the morphologists' in the hind wing).

At this point I wish to express my gratitude to Dr. H. T. Fernald and Dr. G. C. Crampton for their many helpful suggestions and assistance in preparing this paper.

ANATOMY

Head

The sclerites of the head capsule of the squash bug are solidly fused together making it impossible to do more than to describe the general regions of which the head is composed. Of these the occiput (occ), (Pl. LV, f. 1.) lies behind the ocelli (oc) and forms the posterior portion of the head surrounding the occipital foramen. It is marked off by a shallow transverse groove, from

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the vertex. The vertex or cranium (ec) comprises the dorsal region in front of the occiput and bears the ocelli. This area is not marked off from the frons (f), which lies above and between the bases of the antennae (ant). The anterior margin of the frons is united with the base of the clypeus or tylus (c).

Below and on either side of the compound eyes (e) lie the genæ (g) while the ventral posterior portion of the head capsule forms the basal plate or gula (gu). The clypeus, as has been previously stated, is fused at its base with the frons, and at this point is narrow, but as it curves forward and downward it widens at its tip to form the base of attachment for the labrum (lbr) from which it is separated by a narrow membranous ring.

The labrum is an elongate triangular sclerite. Its anterior surface is convex, while its posterior surface is flat and contains a groove which lies above the groove on the basal half of the anterior surface of the labium (lab).

On either side of the clypeus is a narrow prolongation of the frons called the fulcrum, jugum or zygum (fr). The fulcra lie close to the lateral walls of the clypeus, hiding them, but are not united with them except at their bases, where they fuse with the head capsule. The fulcrum is shorter than the clypeus, its anterior margin lying behind the swelling of the tip of the clypeus. Its ventral margin extends to the base of the antenna where it fuses with the base of the maxillary laminae (ml).

The maxillary laminae or gena postica lie below the base of the antennae. Their bases are fused with the genæ and their ventral margins are united with the bucculæ (bu), which are chitinous plates projecting from the anterior ventral side of the head on either side of the base of the labium. The bucculæ serve to protect the posterior membranous portion of the base of the labium.

The rostrum, vagina or labium (lab) articulates with the anterior ventral region of the head between the bucculæ and is made up of four segments, the terminal segment at its tip bearing numerous sensory organs. The labium contains, as stated above, a dorsal groove in which lie the setæ (s). The edges of the groove, distal to the overlying labrum, overlap, forming a closed tube, thus giving the enclosed setæ more support (Pl. LVI, f. 8 s.). At its basal end the groove becomes very shallow; the labium becomes filled with muscles, tracheæ and nerves, and the setæ in this portion of the labium gradually come to lie

within the labrum, whose edges meet beneath and confine the setæ (Pl. LVI, f. 8 s. and Pl. LVI, fs. 21-24′s). They then pass back through the articulating membrane, which lies between the labrum and clypeus, and between the lateral walls of the clypeus. The walls of the clypeus at its tip, turn under, and their edges interlock forming a narrow pair of supporting lobes above which the setæ pass. Upon emerging from these lobes the maxillary setæ (m) spread apart to receive the tip of the pharynx and the canal from the salivary pump, both of which enter the setæ at this point.

The setæ represent the mandibles (md) and the maxillæ (m). The maxillæ are fluted and interlocked so as to form two tubes, these being the upper or suction canal, and the lower or salivary canal (Pl. LV, f. 2). The mandibles are slightly shorter than the maxillæ and their tips are barbed. Their function is that of piercing the plant tissue and holding the setæ in place, while the tips of the maxillæ, which are acute and fluted, probe the plant tissues, take up the plant juices, and eject the saliva. The setæ, as stated, pass back into the head capsule and separate at their junction with the pharynx, going to either side of it. Their bases widening out form points of attachment for the controlling muscles.

The antennæ (ant) are composed of six segments. The third and fifth are ring joints (Pl. LVII, f. 16, r.), or reduced segments; therefore the antenna as a whole appears to be composed of only four segments. The fifth segment, or second ring joint, allows great freedom of motion to the terminal segment. The second and fourth segments are long and slender. The proximal segment is called the scape or radicula (sa). It is large and has a stalked base, which enlarges at its connection with the head to form a universal joint. The terminal segment is spindle shaped and covered with numerous sensory hairs. The other segments possess sensory hairs, but not as specialized as those of the terminal segment.

The compound eyes (e) are large and composed of many facets, and project prominently from the head. The ocelli are two in number.

The posterior portion of the head or the collum is set into the collar of the prothorax and is joined to it by a membranous neck.

Thorax

Prothorax.—The prothorax is a large chitinous segment whose sclerites are solidly fused together, with the exception of the episternum and epimeron which are separated for a short distance by the coxal cleft (b).

The notum (no) overlaps the prescutum, scutum, and a portion of the scutellum of the mesothorax dorsally; and the pleural region projects over a portion of the anterior part of the mesothorax laterally (Pl. LV, f. 1 and 4). The tergum or notum is of one piece, its sclerites being indistinguishably fused together. Its anterior portion is more or less irregular due to the attachments of the muscles of the fore leg to its inner surface. The union of the notum and pleuron forms a well defined ridge.

The Pleuron (pl) is divided, as stated above, by the coxal cleft into the epimeron (epm) and episternum (eps). The cleft extends only a short distance into the pleuron terminating in a groove. Above this the pleuron bulges out forming a larger cavity for the expanding muscles of the fore leg. This region of the pleuron is called the omium (om).

The sternum (st) is a small area lying between, and anterior to the coxal cavities, and is indistinguishably fused with the pleuron. The portion of the sternum projecting backward between the coxal cavities is called the mucro (mu). The anterior portions of the coxal cavities are formed by the inner surfaces of the epimeron, episternum, and the sternum; and are closed posteriorly by the extensions of the prothorax epimeron and sternum, together with the anterior portion of the mesosternum.

The legs show the usual five divisions into the coxa (co), trochanter or fulcrum (fr), femur (fe), tibia (t), and tarsus (ta), (Pl. LVI, f. 13). Since the fore legs are typical, although they are proportionately smaller, one description will be sufficient. At the base of the coxa hidden within the coxal cavity is a narrow plate called the trochantin (Pl. II, f. 9 ti). The coxa is a large swollen segment lying largely within the coxal cavity and is freely movable. The trochanter or fulcrum is a small segment which forms a ginglymus articulation with the coxa and is obliquely joined to the side of the femur. The femur is long and more or less spindle shaped; the tibia articulates with it by a ginglymus joint and is long and slender. The tarsus is composed of three segments. The first segment is called

the Metatarsus (meta), and the terminal segment the ungula (u). This bears divergent claws called unguicula (ua) beneath each of which lies a pulvillus (pu) modified to form a concave adhesive pad (Pl. LV, f. 3).

Mesothorax.—The mesothorax is attached to the prothorax by the intersegmental membrane, and the two segments are easily separated, thus uncovering the anterior area of the scutellum and the scutum and prescutum. The covered areas, or the scutum and prescutum, are also called the dorsulum.

The scutum (sc) is divided longitudinally by a wide median furrow. In the scutum, on either side of the median furrow are two irregular longitudinal impressed lines (d), which are possibly homologous with the parapsidal furrows of the Hymenoptera. If this be the case, then the area lying between the two last mentioned impressed lines would be the prescutum (psc), while the areas lateral to the lines would be the scutum (Pl. LVI, f. 10).

Lying posterior to the scutum and separated from it by a transverse ridge is the scutellum (sct), which is triangular in outline and projects posteriorly over the metathorax and the first abdominal segment. On the lateral edge of the scutellum is a ridge called the frenum (fm) (Pl. LVI, f. 10).

The postcutellum (psct) of the mesothorax forms the anterior wall of the phragma (phr) situated between the meso and the metathorax, while the prescutum (psc) of the metathorax forms its posterior wall. Both of these sclerites are only slightly visible externally (Pl. LVI, f. 10).

The fore wings are characteristic of the suborder Heteroptera being partly membranous and partly coriaceous. Their bases articulate with the mesonotum by means of small chitinous plates called ossicula or axillaries.

The membranous and coriaceous portions of the fore wings are separated by a more or less broken oblique suture called the sutura membranæ (s-m). The coriaceous portion is marked off into three areas by two longitudinal sutures (Pl. LVIII, f. 19). These areas are as follows: the clavus (cl), which lies next to the mesoscutellum when the wings are in repose; the corium (cr) which lies between the two sutures; and the embolium or costal area (em), which lies beyond the second suture. The first suture or the one which marks off the clavus is called the sutura clavi or anal furrow (s-c). The suture separating the corium from

the embolium is called the median furrow (m-f). The margin of the clavus, which when the wing is at rest lies along the lateral edge of the mesoscutellum, is called the margo scutellaris (m-s), while the margin of the clavus beyond the tip of the mesoscutellum, is called the commissura (cm).

There are three angles in the coriaceous portion, used in classification. These are as follows: the internal angle, angulus internus (a-i) formed by the meeting of the sutura membranæ and the sutura clavi; the angulus clavi (a-c), which lies between the sutura clavi and the commissura; and the angulus scutellaris (a-s), which is formed by the meeting of the commissura and the margo scutellaris.

The coriaceous portion of the wing has an inconspicuous venation to which the following names have been given. The costa (ca) is the longest vein, lying nearly parallel to the costal margin of the wing. The subcosta (sca) and radius (ra) lie posterior to the costa, their basal halves being coalesced. Behind or posterior to the coalesced subcosta and radius, lies the median vein (me) connected by a short cross vein (r-m) near its tip with the radial sector. The cubitus (cu) lies within the clavus; and the first anal vein (a) lies along the margo scutellaris except at its base where it extends into the clavus.

The anterior part of the mesopleuron is hidden under the prothorax. It is partially divided into two sclerites, the epimeron and the episternum, by the coxal cleft over the insertion of the mesocoxa. A third plate which is a marked off portion of the epimeron lies at the base of the fore wing and is wholly hidden by the prothorax. It is called the basalar plate (ba). A chitinous plate called the prealar bridge (o) connects the pleuron and the scutum near the juncture of the mesothorax with the prothorax. Below this plate lies the mesothoracic spiracle (sp) in the intersegmental membrane between the meso and prothorax. Posterior to the basalar plate is an invaginated triangular apodeme (ap) whose position is indicated externally by a cavity. A continuation of one of the angles of this cavity marks off part of the dorsal border of the pleuron causing it to appear as a sclerite. A membranous area extends from the base of the fore wing to the prealar bridge, and separates the scutum from the pleuron and its plates.

The sternum is of one piece solidly fused with the episternum. The coxal cavities are formed by the inner surfaces of the

epimeron, episternum and sternum anteriorly, and posteriorly by the anterior margin of the metasternum and metæpisternum.

Metathorax.—The notum of the metathorax is well developed and is composed of three sclerites. The prescutum (psc), which has already been described, forms the posterior wall of the phragma between the meso and metathorax, and in its normal position is only slightly visible from the exterior. The scutum (sc) and scutellum (sct) are fused and the visible portions appear as an elongate triangular sclerite on either side of the mesoscutellum which hides the middle portion. The postscutellum (psct) lies behind this sclerite and is fused with it, its central portion being hidden beneath the projecting mesoscutellum.

The pleuron (pl) is partially divided by the coxal cleft into a large epimeron or pleurum and a very small episternum, the latter being indistinguishably fused with the sternum. At the upper end of the cleft lie the two light yellow scent glands (sg) separated by a pit which extends into the body cavity and into which flows the fluid secreted by the glands. Lying above the scent glands and hidden in the folds between the meta and mesothorax is the metathoracic spiracle. On either side of the dorsal margin of the metapleuron is a longitudinal grooved area called the cenchrus (Pl. LV, f. 4, cc and Pl. LVI, f. 10, cc), in which there lies a ridge, located on the ventral side of the costal margin of the fore wing.

The hind wings or alæ (hw) are joined to the metathorax although their bases appear to lie mostly above the mesopleuron when viewed laterally. Their bases articulate with the fused scutum and scutellum, whose posterior margin is continuous with the posterior margin of the wing. The alæ articulate with the metanotum by means of numerous small chitinous plates called ossicula or axillaries.

The wing is wholly membranous and distinctly veined. The venation given is the purely systematic one. The costa primaria (ca-p) is the large vein lying just posterior to and parallel with the costal margin in the basal half of the wing (Pl. LVIII, f. 20). The costa subtensa (ca-s) lies below the costa primaria and is more or less parallel with it. Near the distal end of the costa subtensa is a short incomplete transverse vein which nearly reaches the costa primaria. This is called the Hamus (ha). The distal ends of the costa primaria and subtensa are connected

by a short vein, the costa connectens (ca-c). From the union of the costa primaria and costa connectens the costa apicalis (ca-a) extends outward toward the apex of the wing. Behind the costa apicalis and nearly parallel with it lies an unnamed vein which is usually unbranched although in an abnormal specimen a short branch vein has been noticed arising from it and extending outward between it and the costa apicalis. From the union of the costa subtensa and the costa connectens extends the costa decurrens (ca-d), a strongly curved vein. Behind the costa decurrens lie two nearly straight, short veins called the costa lineatæ (ca-l). Behind the costa lineatæ lie three veins in the anal area, the costa radiantes (ca-r). The first is not attached to the base of the wing while the second and third are so attached.

Abdomen

The abdomen is broadly joined to the thorax and its anterior portion is overlapped by the metathorax to such an extent that the spiracle situated in the pleural region of the first abdominal segment is completely hidden beneath the metapleuron. The first six segments of both male and female bear a pair of spiracles.

The first four and part of the fifth segments of the abdomen show clearly the marking off into four typical regions. The notum (no) is the flat, black, dorsal portion on which the wings rest. The pleural areas or connexivum which form the sides of the trough in which the wings lie when at rest are situated one on either side of the dorsal region, and extend to the prominent lateral edges of the abdomen. The sternal area is that forming the ventral and lateral portions of the abdomen. The spiracles (sp) are located near the dorsal edges of the sternum. The sclerites of the posterior portion of the fifth segment, and of the segments following, are more or less closely fused together and are specialized for reproduction in both males and females.

There are nine segments in the abdomen of the male. The seventh is not visible under normal conditions, but together with a large part of the eighth segment, is retracted within the sixth segment. The seventh segment is highly specialized for this purpose, being merely a collar of chitin which telescopes over the base of the eighth segment. The eighth or genital segment is also highly specialized, its sclerites being solidly

fused together, except dorsally where the chitin is almost membranous just anterior to the rectal cauda (rc). Its shape is also greatly modified. The dorsal aspect presents a large pit or cavity, above which lies the rectal cauda and the genitalia. The chitinized tip of the rectal cauda is the much modified ninth segment. The rectal cauda projects posteriorly from the dorsal wall of the eighth segment, which is called the pygidium (pg). The basal half of the rectal cauda is membranous above and below, but slightly chitinous laterally. Its posterior half, which lies folded and hidden within the basal portion, is membranous except the tips which are chitinized, and open and close as do the edges of a purse. Beneath the basal portion of the rectal cauda lies the œdeagus, those chitinized portions of the male genital organs through which pass the membranous structures connected with the ejaculatory duct. Posterior to the œdeagus lie two movable appendages or styli (la). The ventral portion of the eighth segment which bears internally the lateral appendages and contains the œdeagus is called the hypopygium (pp).

Dorsally, the abdomen of the female presents ten segments. The tenth, which forms the chitinous lips of the rectal cauda, is hidden within the ninth, except when extruded, and is widely separated from the ninth by the membranous rectal cauda. The dorsal portion of the ninth segment is called the pygidium. Ventrally, the ten segments are not so easily recognizable, especially when the abdomen is extended, as the segments are variously modified for protective and reproductive purposes. Attached to the insides of the dorsal and ventral portions of the eighth abdominal segment are two pairs of chitinous appendages, the lateral appendages or styli, armed with stiff spines or hairs. These lie above and protect the soft portions of the genitalia when in repose. These appendages may function as claspers in copulation, but actual observation of this function will be necessary to determine this point. The ventral portion of the eighth abdominal segment is called the hypopygium.

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LETTERING OF FIGURES.

Numbers 1-10 denote number of the segment. Subscripts 1, 2, 3, pro-, meso-, metathorax, respectively.

a	anal vein.
a-c	angulus clavi.
a-i	angulus internus.
a-s	angulus scutellaris.
ab	abdomen.
ant	antenna.
ap	apodeme.
b	coxal cleft.
ba	basalar plate.
bc	bulb of antenna.
bu	bucculæ.
c	clypeus or tylus.
ca	costa.
ca-a	costa apicalis.
ca-c	costa connectens.
ca-d	costa decurrens.
ca-l	costa lineatæ.
ca-p	costa primaria.
ca-r	costa radiantes.
ca-s	costa subtensa.
cc	cenchri.
cl	clavus.
cm	commissura.
co	coxa.
cr	corium.
cu	cubitus.
d	parapsidal furrows.
e	eyes.
em	embolium.
epm	epimeron; mesothoracic epm = scapula; metathoracic epm = pleurum.
eps	episternum.
f	frons.
fe	femur.
fm	frenum.
fr	fulcrum, jugum or zygum.
fw	fore wing.
g	gula.
hw	hind wing, ala.
la	lateral appendages, styli.
lab.	labium, rostrum, vagina.
lbr	labrum.
m	maxillary setæ.
m-f	median furrow.
m-s	margo scutellaris.
md	mandibular setæ.
me	median vein.
ml	maxillary laminæ, gena postica.
mta	metatarsus.
mu	mucro.
n	salivary canal.
no	notum.
o	prealar bridge.
oc	ocelli.
occ	occiput.
om	omium.

p	suction canal.	s-m	sutura membranæ.
pg	pygidium.	sa	scape.
phr	phragma.	sc	scutum.
pl	pleuron; abdominal pleuron = connexivum.	sca	subcosta.
		sct	scutellum.
pp	Hypopygium.	sg	scent glands.
psc	prescutum.	sp	spiracles, stigmata.
psct	postscutellum.	st	sternum.
pu	pulvillus.	t	tibia.
r	ring joints.	ta	tarsus.
r-m	connecting vein between ra and me.	ti	trochantin.
		tr	trochanter, fulcrum.
ra	radius.	u	ungula.
rc	rectal cauda.	ua	unguicula.
s	setæ.	v	vertex, cranium.
s-c	sutura clavi, anal furrow.		

EXPLANATION OF PLATES.

PLATE LV.

Fig. 1. Lateral view of head, thorax and first segments of the abdomen.
Fig. 2. Cross section of the mandibular and maxillary setæ.
Fig. 3. Lateral view of a tarsal claw and the adhesive pad or modified pulvillus lying beneath it.
Fig. 4. Lateral view of the meso- and metathorax, as seen looking obliquely backward, the prothorax being removed and the wings raised and the abdomen abnormally extended to show the spiracle on the first segment.
Fig. 5. Dorsal view of the abdomen. The female genitalia are not extended.

PLATE LVI.

Fig. 6. Maxillary setæ showing fluted and piercing tips; (see fig. 2 cross section of maxillary setæ).
Fig. 7. Mandibular setæ showing barbed and piercing tips.
Fig. 8. Cross section of labium at the tip showing how the setæ are supported.
Fig. 9. Coxa and trochantin.
Fig. 10. Dorsal view of the meso- and metathorax with the wings extended.
Fig. 11. Lateral view of the male genitalia extended.
Fig. 12. Ventral view of the male genitalia normally retracted.
Fig. 13. Typical leg.
Fig. 14. Lateral view of female genitalia normally retracted.

PLATE LVII.

Fig. 15. Dorsal view of male genitalia extended.
Fig. 16. Antenna.
Fig. 17. Ventral view of the insect showing female genitalia.
Fig. 18. Lateral view of female genitalia extended.

PLATE LVIII.

Fig. 19. Fore wing.
Fig. 20. Hind wing.
Figs. 21-24. More or less diagrammatic.
Fig. 21. Cross section of second segment of the labium, showing the position of the setæ.
Fig. 22. Cross section at the tip of the first segment of the labium, showing the position of the setæ.
Fig. 23. Cross section at about the middle of the first segment of the labium, showing the position of the setæ.
Fig. 24. Cross section at the base of the labrum, showing how the setæ are supported.

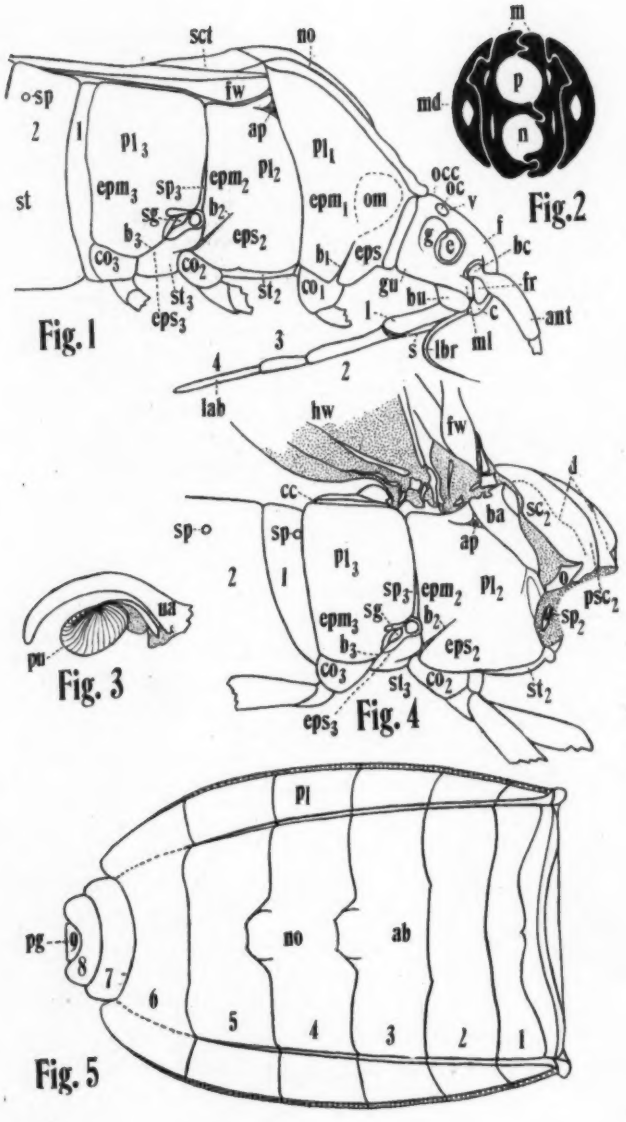

Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

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Fig. 6

Fig. 7

Fig. 8

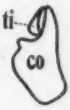

Fig. 9

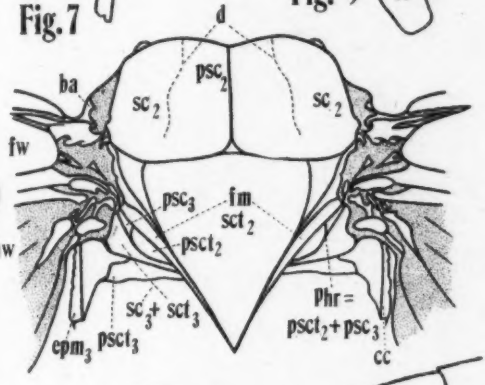

Fig. 10

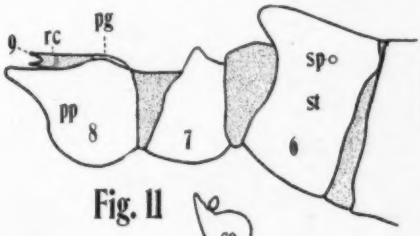

Fig. 11

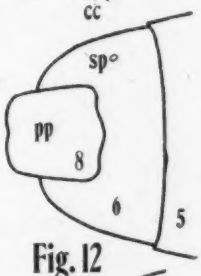

Fig. 12

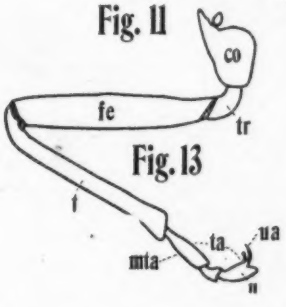

Fig. 13

Fig. 14

D. G. Tower.

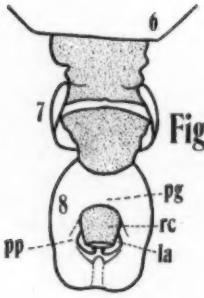

Fig. 15

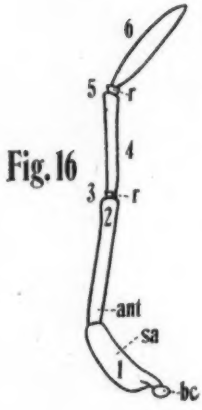

Fig. 16

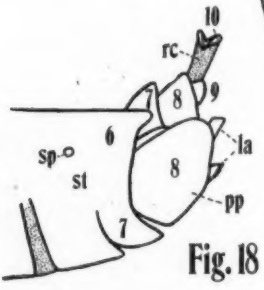

Fig. 18

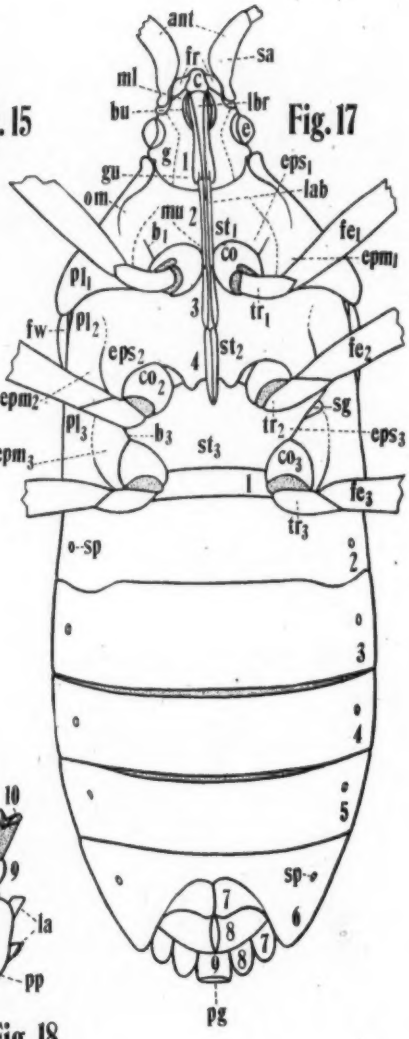

Fig. 17

D. G. Tower.

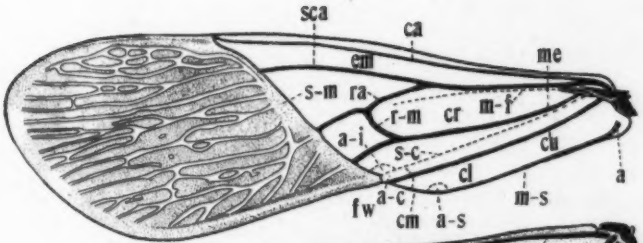

Fig. 19

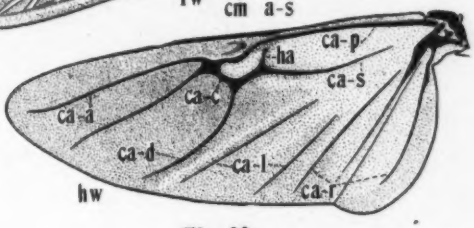

Fig. 20

Fig. 21

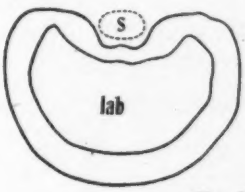

Fig. 23

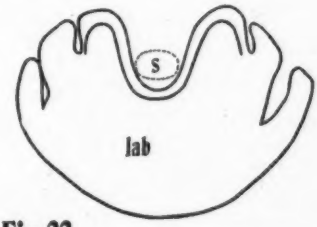

Fig. 22

Fig. 24

D. G. Tower.

THE DIPTERAN FAUNA OF BERMUDA.

By Charles W. Johnson.

Since publishing a list of the Diptera of Bermuda in 1904, (Psyche, vol. XI, pp. 76-80), I have received a number of specimens from Professor Trevor Kincaid, collected in the summer of 1905, and from Mr. Frank Morton Jones, collected December, 1908-May, 1909, and Dr. Reynold A. Spaeth, collected in the summer of 1910. The material thus obtained at various seasons of the year together with the notes kindly furnished by Mr. Jones, greatly increase our knowledge of the Diptera of the Islands. The study of this material has brought out many interesting points in distribution, some of the species derived from the mainland having become either slightly or decidedly differentiated.

The previous list contained about fifty species. Little of the data has been repeated, although all of the species are included in the following list, which contains about ninety-five species.

Tipulidae.

Tipula costalis Say. "This fly was abundant at Paget Marsh in February and March, but seemed to completely disappear later." (F. M. Jones).

Dicranomyia liberta Osten Sacken. July 7, at light, (Kincaid), Feb. 14 (F. M. Jones).

Gonomyia (Leiponeura) pleuralis Will. This seems to be the most common Tipulid and the one previously recorded as *Dicranomyia distans*, Osten Sacken. It was taken by Professor Kincaid, July 5 and 20, and by Mr. F. M. Jones, Feb. 19 and May 6 and 8.

Limnophila insularis sp. nov. Fig. 2.

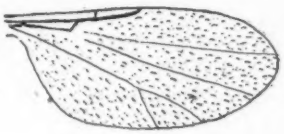

Fig. 1

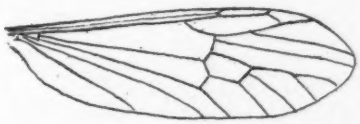

Fig. 2.

This species has a general resemblance to *L. recondita* Osten Sacken. The antennæ in both sexes are of equal length, light yellow, flagellum dark brown, the verticilli much shorter than in *L. recondita*. Head blackish, covered with a greyish bloom. Thorax shining brown, pleura dull yellow with a greyish bloom. Abdomen dark brown,

genitalia yellow. Halteres yellow, knob somewhat infuscated. Legs yellowish, tarsi brownish toward the ends. The wings are noticeably shorter and broader toward the base than in *L. recondita*, the præfurca is shorter and the marginal cross vein at the middle of the anterior branch of the second vein is close to the tip of the first longitudinal vein. Length, ♂ 6mm. ♀ 7mm.

Two specimens. ♂, March 10, ♀, May 1, 1909, (F. M. Jones).

PSYCHODIDAE.

Psychoda alternata Say. Nine specimens were received from Mr. Jones. These were collected by Mr. Mowbray, May 15.

Psychoda sp. A larger species was collected by Prof. Kincaid and retained by him for study.

CHIRONOMIDAE

Chironomus cristatus Fabricius. July 26 (Kincaid); Paget Marsh, March 10, (F. M. Jones); near Hamilton, June 26 (Spaeth).

Orthocladius sp. July 15 (Kincaid).

Metriocnemus knabi Coquillett. Eight specimens, February 1 (F. M. Jones).

Ceratopogon fur sp. nov. Fig. 1.

Female: Head black, proboscis brown, palpi black, antennæ black, covered with a thick grayish pubescence, apparently with fourteen joints. Thorax black, subshining, hairs grayish, scutellum dark brown, abdomen dull black, thickly covered with grayish hairs. Legs brown, tip of the tarsi and claws black, posterior metatarsi as long as the following joints. Halteres black, the stalks short and thick, the knobs proportionately large. Wings smoky, strongly pubescent, venation as shown in the figure, the third and fourth longitudinal veins obsolete toward the basal portion of the wing. Length, 1mm.

Two species, Warwick Marshes, April 16 (F. M. Jones).

The two specimens were attached to a small dragon fly, (an Agrionid), with the mouth parts extended into the sutures near the base of the wings apparently in the act of biting. This is the second time that the writer has seen a *Ceratopogon* attached to an insect. The first example was also taken by Mr. Jones, the flies being attached to the wings of a *Chrysopa*. This specimen was loaned to Dr. E. P. Felt in connection with his studies of the Cecidomyiidæ, as a species of the latter family has been recorded by Mrs. Annie T. Slosson as also attaching itself to the wings of a *Chrysopa*. (Ent. News, VII, 238, 1896).

Ceratopogon sp. July 12 and 29 (Kincaid).

CULICIDAE.

Stegomyia calopus Meigen, (*Stegomyia fasciatus* Fabr.) The "yellow fever mosquito," June 25-29 (Kincaid); Jan. 22 and Feb. 18, May 6, and 10, 1909 (F. M. Jones).

Aedes sollicitans Walker, (*Culex sollicitans* Walk.). The salt marsh mosquito, July 6-12 (Kincaid); Walsingham, Feb. 16, Apr. 8 (F. M. Jones).

Aedes taeniorhynchus Wiedemann. (*Culex taeniorhynchus* Wied.). July 7-23 (Kincaid).

Culex quinquefasciatus Say, (*C. fatigans* of Theobald not Wiedemann; *C. cubensis* Bigot). Record by Theobald from collections made by Dr. Eldon Harvey, July 1899.

MYCETOPHILIDAE.

Sciara sp. June 25 (Kincaid).

CECIDOMYIDAE.

Cecidomyia sp. June 25 (Kincaid).
Cecidomyia sp. June 25 (Kincaid).

BIBIONIDAE.

Dilophus breviceps Loew. Warwick Swamp, April 16, (♂ ♀). "In sweep net, in great numbers on one occasion only." (F. M. Jones).
Scatopse pygmaea Loew. June 28 and 30 (Kincaid).
Scatopse atrata Say. Recorded by Prof. Verrill.

STRATIOMYIDAE.

Hermetia illucens Linne. July 1 (Kincaid); May 13 (F. M. Jones).
Odontomyia bermudensis sp. nov.

Female: This species is closely related to *O. cincta* Oliv. and might be considered by some only a variety, but the apparent constancy of the seven specimens before me seems to warrant their separation. The two principal characters which readily distinguish this species are the conspicuous black stripes extending from the humeri to the base of the wings, dividing the green lateral stripes of the thorax from the green pleura, and the dark brown color of the larger vein, this color also extending over the costal and marginal cells and the base of the wing. Minor characters are the greater amount of black on the head, the black of the vertex being often connected with the large black orbital spots of the front, from which extend narrow curved lines to the frontal suture, and a narrow frontal stripe, which is also often present. The black markings of the abdomen are much larger, covering fully two thirds of the surface, while in *O. cincta* the black rarely exceeds one half. Six of the specimens have a dark yellow scutellum, but this may be a discoloration, as it occasionally appears in *O. cincta*. Length 10 to 12mm.

Six specimens, May 9 and 11 (Jones); one specimen, July 26 (Kincaid). "Not rare on the flowers of wild carrot, especially along the borders of the Warwick Marshes" (F. M. Jones).

TABANIDAE.

Tabanus atlanticus sp. nov.

Female: Face white with white hairs, above the base of the antennæ slightly yellowish; front with grayish pollen and brown hairs, callosity large, shining black, with a short, slightly roughened line extending upwards; palpi light yellow with black hairs, proboscis brown; antennæ yellow, with tufts of black hairs on the upper and of white hairs on the under sides of the first and second joints, third joint not angulate, annuli brown. Thorax gray with four obscure

brown stripes, hairs whitish; pleura mottled with bluish-black and covered with whitish pollen and hairs; scutellum grayish. Abdomen brown with a lighter posterior margin on each segment, the entire surface with a white pubescence. Legs yellow, under side of the posterior femora and tips of all the tibiæ and tarsi brown, front coxae with long, white hairs; halteres light yellow. Wings hyaline, stigma and cross-veins clouded with brown. Length, 13mm.

The ♂ differs but little from the ♀, except that the facets on the upper two-thirds of the eye are double the size of those on the lower third. The stripes on the thorax are obsolete. Length 10mm.

Three specimens collected by Professor Kincaid, July 10 and 30.

Tabanus nigrovittatus Macquart.

In writing to Mr. Jones regarding a larger horse-fly than this species, he says: "This is undoubtedly the 'large horse-fly' you asked me to look out for; the carriage-drivers assured me that no larger species occurs here. It is said to be locally abundant in the summer time, but up to May 20 I saw only one living example; the other specimen I got from a local collector who confirmed the drivers' statement." It seems, therefore, probable that the reference to a larger species, (Psyche vol. XI, p. 77) applies also to this species.

SCENOPINIDAE.

Scenopinus nubilipes Say. One specimen, May 15 (F. M. Jones).

ASILIDAE.

Asilus? sp. Recorded by Professor Verrill.

DOLICHOPODIDAE.

Sciapus chrysoprasius Walker. Not rare, March 20, 30 and May 12 (F. M. Jones).

Sciapus pallens Wiedemann. Three specimens, April 17, May 18 and 19, resting on the white walls. (F. M. Jones).

Diaphorus contiguus Aldrich. Seven specimens, June 30 to July 26 (Kincaid).

Chrysotus picticornis Loew. Three specimens July 15' (Kincaid). Common. Spanish Point, July 5 (Spaeth).

Chrysotus bermudensis sp. nov.

Front shining green, face with silvery white pollen; antennæ black, small. Thorax and scutellum shining green, slightly covered with a yellowish pollen; pleura greenish black, with whitish pollen.. Abdomen shining with a narrow bronze band at the base of each segment. Legs including the front coxæ yellow, middle and posterior coxæ black; a preapical band on the posterior femora, and the extreme tips of the tarsi dark brown. Halteres, tegulæ and cilia light yellow, wings grayish hyaline. Length, 2mm.

Three females, June 20, July 26 (Kincaid). Holotype in the author's collection; one paratype in the Museum of Comparative Zoology. This species is closely related to *C. pallipes* Loew, but seems readily separated from that species by the dark preapical band on the posterior femora.

PIPUNCULIDAE.

Pipunculus insularis Cresson, (Trans. Amer. Ent. Soc., vol. 36, p. 317, 1911). Hamilton parish, May (S. Brown); July 29 (Kincaid); Agars Island, June 18, and Spanish Point, July 5 (Spaeth).

Pipunculus albiseta Cresson, (Trans. Amer. Ent. Soc., vol. 36, p. 318, 1911). Hamilton Parish, May. (S. Brown); Jan. 27 (F. M. Jones).

Allograpta obliqua Say. "Abundant throughout the winter," Dec. 11 to Jan. 25 (F. M. Jones); Agar's Island, June 18 (Spaeth).

Toxomerus marginatus Say. (*Mesogramma marginatum* Say, of the previous list). "Very abundant and present throughout the winter and spring (Dec. 8 to May 3). A specimen was bred April 1, from a larva found in the flowers of the Bermuda blue-eyed grass." (F. M. Jones). On the road from Hamilton to Grasmere (Spaeth). The larvae are aphidivorous.

Eristalis tenax Linne. "The first specimen was taken February 18; afterwards not rare on flowers, but never abundant." (F. M. Jones).

Eristalis æneus Scopoli. (*Lathyrophthalmus æneus* Scop.). "Most abundant on flowers along the cliffs of the south shore, where it was present throughout the winter" (F. M. Jones). Specimens bear the following dates: December 14, 24; January 19; February 6 and March 4.

SARCOPHAGIDAE.

Sarcophaga georgina Wiedemann? Both Professors Walker and Verrill referred the large flesh fly of the Island to *S. carnaria* Linne. Among the series collected by Messrs. Davis, Kincaid and Jones there is not a specimen referable to that species. They represent the large species with reddish genitalia which I have referred doubtfully to *S. georgina.*

Sarcophaga assidua Walker. Numerous specimens agree with the description of this species. Feb. 24, April 16 and May 5 (F. M. Jones); Spanish point, July 5 (Spaeth); July 6 (Kincaid).

Sarcophaga sp? Probably two closely related species. The present unsatisfactory condition of our Sarcophagidae precludes the possibility of accurately determining the species.

Helicobia helicis Townsend. Common, April 18 and 26 (F. M. Jones). Spanish Point, July 5 (Spaeth).

Sarcophagula sp. Recorded by Dr. Dahl. I was in hopes of finding the common *S. imbecilla* v. d. W. of the West Indies among the material studied.

MUSCIDAE.

Musca domestica Linne. The common house-fly is abundant throughout the year. June 20 (F. M. Jones); Agar's Island, June 18, and Spanish Point, July (Spaeth).

Stomoxys calcitrans Linne. The biting house fly or cattle fly. Abundant with the common house-fly, June 20 (F. M. Jones); Agar's Island, June 18 (Spaeth); July 11 (Kincaid).

Synthesiomyia brasiliana B. & B. July 29 (Kincaid).

Calliphora vomitoria Linne. Recorded by Prof. Verrill.

Lucilia sericata Meigen. Abundant. Dec. 25 to May 12 (F. M. Jones); July 12-29 (Kincaid); Spanish Point, July 5 (Spaeth). *L. latifrons* Schiner is a synonym.

Lucilia caesar Linne. Recorded by Prof. Verrill.

Lucilia problematica sp. nov.

Male: Front linear as in *L. caesar*, black, orbits whitish pollinose; face black, whitish pollinose, the oral margins and antennæ reddish brown, arista black. Thorax and abdomen bronze black shining, with a slight whitish pollen especially on the sides and on the pleura. Two post-acrosticals. Femora and tibiæ brown and the tarsi blackish. Squamæ and halteres yellow, wings brownish hyaline. Length 7mm.

Female: Similar to the male, front, as in *L. caesar*, one-third the width of the head.

Holotype June 30 (Kincaid); allotype March 1899 (Montgomery), in the author's collection. This interesting species has been in my collection for some time awaiting more material. The first specimen (♀, antennæ wanting) was collected by Mr. Thomas L. Montgomery in March, 1897. A teneral specimen (♂) was taken by the late C. Abbott Davis, July 11, 1903. These were submitted to the late D. W. Coquillett at the time I was preparing my previous list, but he declined to name them without more material. The third specimen (♂) was taken by Prof. Kincaid, June 30, 1905, and a fourth specimen (♀ teneral) by Mr. Frank M. Jones, March 1, 1909. It is close to L. caesar in every respect but color; the entire absence of green or blue, however, seems to preclude placing it in that species. I had hoped that a larger series would show variations approaching that species, but while *L. caesar* was mentioned by Prof. A. E. Verrill, the large series of *Lucilia* brought from the Islands by Messrs. Montgomery, Davis, Kincaid and Spaeth, contained only *L. sericata*.

ANTHOMYIDAE.

Ophyra aenescens Wiedemann. July 6 (Kincaid); December 26 (F. M. Jones).

Fannia pusio Wied. (*F. femorata* Loew) May 9 (F. M. Jones); July 6 (Kincaid).

Fannia polychæta Stein. This is based on *Anthomyia lepida* Meig., recorded by J. Matthew Jones in 1876. It is a doubtful species, referred with a question to this species.

Limnophora narona Walker. (*L. cyrtoneurina* Stein) collected by C. A. Davis, July 14.

Mydæa sp? One imperfect specimen, July 17 (Davis).

Phyllogaster cordyluroides Stein. June 30 and July 12 (Kincaid).

Phorbia fusciceps Zetterstedt. Common, December 26 (F. M. Jones); June 30 and July 29 (Kincaid); Agar's Island, June 18; on the road from Hamilton to Grasmere, June 26; Spanish Point, July 5 (Spaeth). This species infests onions and other vegetables, and is undoubtedly the fly referred to by Verrill as "*Anthomyia ceparum*," "onion fly."

Coenosia sp? July 6 (Kincaid).

Lispa albitarsis Stein? Spanish Point, July 5 (Spaeth). A female agrees with this species except that the palpi are blackish.

Fucillia marina Macquart (*F. fucorum* of authors, not Fallen). In great number on piles of sea-weed, March 6 (F. M. Jones).

SCATOPHAGIDAE.

Scatophaga sp? Recorded.

BORBORIDÆ.

Leptocera fontinalis Fallen, (*Limosina fontinalis*). July 2 (Kincaid).

Leptocera venalicia Osten Sacken. May 3 (F. M. Jones). Supposed to have been introduced into Cuba by the slave trade.

Leptocera illota Williston. Spanish Point, July 5 (Spaeth).

Leptocera sp. Three specimens of a smaller species from a pile of sea-weed, Febuary 4 and March 6 (F. M. Jones). The specimens are imperfect.

Borborus minutus sp. nov.

Male: Front covered with light brownish pollen, two dark brown stripes extending upward from the base of the antennæ and over the vertex, the stripes bearing a narrow whitish line above the antennæ, face brown, cheeks whitish pollinose, antennæ black. Thorax light brownish pollinose with three dark brown stripes, the middle one double the width of the others, scutellum light brown, the disc and apex slightly darker, pleura brownish pollinose. Abdomen dull grayish black. Legs black, the posterior metatarsis about double the width of the following joint. Halteres yellow. Wings grayish hyaline, veins dark brown. Length 2mm.

Holotype, Spanish Point, July 5 (Spaeth), in the author's collection. Two paratypes, Horse Neck Beach, Mass., July 8, 1896, in the collection of the Boston Society of Natural History. The latter were collected by Dr. Garry de N. Hough, and were in my collection for a number of years. I have adopted a manuscript name proposed by Dr. Hough.

SCIOMYZIDÆ.

Tetanocera kincaidi sp. nov.

Male: Face and inferior orbits white, with a brown stripe on the cheek extending from the eye to the oral margin; front yellow, the frontal vitta and a transverse stripe extending from the base of the antennæ to the orbits brown, frontal orbits narrow, white; antennæ yellow, the bristles and hairs on the second joint and the arista black. Thorax yellow, with two narrow dorsal lines and broad lateral stripes of brown; pleura light yellow with a broad brown stripe; scutellum yellow with four black marginal bristles. Abdomen brown, lateral margins and the genitalia yellow. Halteres light yellow. Legs yellow, a spot on the under side of the middle and posterior femora somewhat beyond the middle, tips of the tibiæ and the tarsi blackish, due in part to the blackish hairs, middle coxæ with a tuft of black bristles below, front of the anterior coxæ bearing three bristles. Wings similar to *T. spinicornis* Loew, but proportionately broader and the reticulations less profuse, with five unequally arranged square hyaline spots in the marginal cell beyond the end of the first vein. Length, 5mm.

Female: Similar to the male, but with an obsolete dorsal line on the abdomen. Length 6mm.

Ten Specimens. Holotype, July 29, allotype June 26, 1905 (Kincaid) and three paratypes, May 30 (Mowbray); January 12 and February 5 (F. M. Jones) in the author's collection. Paratypes also in the Museum of Comparative Zoology, and in the Collections American Entomological Society.

With only two poor specimens before me this was referred to *T. spinicornis* in my previous list. It closely resembles that species but can be readily separated by the wings as described above, the single, not double spots on the under side of the posterior femora and the larger and less acute third joint of the antennæ. It is also slightly larger.

The species also resembles *T. setosa* Coq. but the spots on the under side of the posterior femora and the five unequally arranged hyaline spots in the marginal cell beyond the end of the first longitudinal vein distinguish it from that species.

Tetanocera (Dictya) umbrarum Linné (*T. pictipes* Loew, Monog. N. Amer. Diptera, I, 111, 1862). Two specimens, March 20 (F. M. Jones); July 15 (Kincaid).

SAPROMYZIDÆ.

Sapromyza saroria Williston. July 6 and 11 (Kincaid); Jan 6, April 10 and May 4 "On the under side of palmetto leaves in a swamp." (F. M. Jones).

ORTALIDÆ.

Euxesta abdominalis Loew. June 30 (Kincaid). Sweep net, Warwick Marshes, December 11, also March 5 (F. M. Jones).

Euxesta annonae Fabricius. June 26 (Kincaid).

Euxesta pusio Loew. June 26 (Kincaid).

Chaetopis fulvifrons Macquart (*Urophora fulvifrons* Macq. Dipt. Exot., Suppl. V, 125, pl. VII, fig. 8, 1855). July 29 and 30 (Kincaid); March 20 (F. M. Jones). This is probably the same as the *C. aenea* of my previous list, as recorded by J. Matthew Jones in 1876. It differs from the true *C. aenea* in lacking the frontal cross-bristles and in having only three or four frontal orbital bristles.

Chætopsis debilis Loew. Spanish Point, July 5 (Spaeth). This may prove to be only a variety of *C. fulvifrons* Macq. as the color of the basal segments of the abdomen and the bands on the wings, are both apparently variable characters.

Ceratitis capitata Wied. "Fruit fly."

This fly which was introduced sometime prior to 1870 is still on the Islands but in very limited numbers owing to the vigorous campaign that has been waged against it. The authorities deserved great credit for their perseverance in endeavoring to exterminate this insect and we hope that in the near future they may again be able to resume the raising of the various fruits affected. There is little doubt that this vigorous action has for many years checked the western movement of this great fruit pest.

Having written to Mr. F. M. Jones in May, 1909, to ascertain if the fruit fly was still on the Islands, he replied: "In regard to the fruit fly (*Ceratites*); several years ago a regular crusade against this insect was undertaken and is being continued. All of the Surinam cherry trees were cut down, also most of the sweet orange trees and peach trees. Inspectors were appointed in each parish and authorized to visit every tree and strip off the unripe fruit,—oranges, lemons, sapadillas, loquats, sugar-apples, etc.; pawpaws were ordered to be gathered before turning yellow, under the penalty of having the trees chopped down. All this was in an effort to entirely exterminate the insect, it has undoubtedly greatly reduced its numbers for I failed to find a specimen, though I searched all kind of fruits where I could find any which had escaped inspectors. I heard of the fly as still present this spring. The crusade has not the support of the people and trees are concealed from the inspectors when possible, so that probably when the vigilance is relaxed the insect will appear again. There are several wild fruits which should be examined as possible breeding places. Sorry I could not get you some specimens."

Expressing to my friend Dr. R. A. Spaeth a desire to obtain some specimens of the "fruit fly" he spoke to Col. W. R. Winter who bred some specimens which I received though the kindness of Professor E. L. Mark. The letter accompanying the specimens contains so much of interest pertaining to the habits of the fly that I have taken the liberty of publishing it in part.

"With reference to the experiments, several punctured peaches placed in isolation cages, developed flies in from seven to ten days from the time in which the larvæ entered the soil, as I had not the actual date of the depositing of the eggs, I did not trouble to keep an exact record beyond noting the dates of the larvæ leaving the fruit and the appearance of the fly."

"Two peaches in perfect condition were left on an exposed branch of the tree and watched, but owing to the scarcity of flies it was not until 4 P. M. on the 13th of July that a fly appeared and punctured one of them; after ten minutes I killed the fly. The peach was carefully examined and one puncture only was found. On the 17th the fruit was found to be soft around the puncture and was gathered. It was placed in a gauze covered glass jar on two and a half inches of clear, dry sand. On the 24th at 10 A. M. the maggots were observed going into the sand, many of them being visible through the sides of the glass, they having gone down between the sand and the glass. On the 27th the peach was removed and examined. Two dead maggots were found in it. The pupæ were carefully separated from the sand and twelve more were found, these were placed in dry soil in an isolation cage made especially for this experiment. The flies appeared as follows: two on the 1st of August at 7 and 10 A. M. Three on the 2nd, before 4 P. M. Two on the 3rd, before 7 P. M., and on the 4th, before 9 A. M. Carried no further as all flies fed on arsenate of lead which was placed in the cage and were found dead on the 5th at 7 A. M. Weather very hot and dry, no rain, temperature averaging 82°.

Aciura insecta Loew. June 26 (Kincaid); Spanish Point, July 5th (Spaeth).

Ensina picciola Bigot, (*Trypeta humilis* Loew). Abundant in sweep-net, December 8 and 29 and May 17 (F. M. Jones). Road from Hamilton to Grasmere June 26 and Spanish Point July 5 (Spaeth).

SEPSIDÆ.

Sepsis violacea Meigen. "Common January 21 and April 29 (F. M. Jones); June 30 and July 29 (Kincaid); Spanish Point, July 5 (Spaeth).

Piophila casei Linné. The cheese fly. Recorded by Prof. Verrill.

EPHYDRIDÆ.

Mosillus nana Walker? (*Ephydra nana* Walker, Trans. Ent. Soc., London, N. Ser. IV, 234, 1857). July 30 (Kincaid); Spanish Point, July 5 (Spaeth).

Ephydra austrina Coquillett. One specimen collected by C. A. Davis.

OSCINIDÆ.

Hippelates plebeius Loew. June 28 and 30 (Kincaid); Agar's Island, June 18 (Spaeth).

Hippelates pusio Loew. July 12 (Kincaid).

Oscinis coxendix Fitch. Common. June 30 and July 12-18 (Kincaid); February 4 (F. M. Jones); near Hamilton, June 26 and Spanish Point, July 5 (Spaeth).

Oscinis trigramma Loew. July 11, 15 and 26 (Kincaid).

Oscinis umbrosa Loew. Common, June 25 to July 29 (Kincaid).

DROSOPHILIDÆ.

Drosophila adusta Loew. July 25, 29 (Kincaid); February 4 (F. M. Jones).

Drosophila ampelophila Loew. January 7 (F. M. Jones).

Drosophila repleta Wollaston, (*D. punctulata* Loew, Berl. Ent. Zeits., VI, 232, 1862; *D. adspersa* Mik, Wien. Ent. Zeitzg. V. 328, 1886.) January 1 and May 6 (F. M. Jones).

Paratissa pollinosa Williston, July 10 (Kincaid); December 24 and March 6, on sea-weed (F. M. Jones).

AGROMYZIDÆ.

Phytomyza sp. January 27, February 24 (F. M. Jones).

Agromyza æneiventris Fallen. July 1 (Kincaid).

Agromyza pusilla Meigen. July 5 (Kincaid).

Agromyza maculosa Malloch. May 17 (F. M. Jones).

Desmometopa m-nigrum Zetterstedt, May 9 (F. M. Jones).

Milichiella lacteipennis Loew, (*Ophthalmomyia lacteipennis*). July 6, 12 and 28 (Kincaid); Spanish Point, July 5 (Spaeth).

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THE TAXONOMIC VALUE OF THE CHARACTERS OF THE MALE GENITAL ARMATURE IN THE GENUS TETRANYCHUS DUFOUR.

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INTRODUCTION.

The red spiders of the genus *Tetranychus* Dufour have always offered a knotty problem for systematists working in the order Acarina. When these mites were first noticed they were found on such a multitude of host plants, and showed such a great variation in color that the early workers considered the genus as being made up of a great many species or varieties. Later it was found that certain well known forms could have a great variety of hosts, also that there was a considerable variation in size and color among individuals on a single host plant. Then there was a tendency to lump the forms together into a very few species, although confusion as to synonymy still remained. In 1877 Professor A. T. Tozzetti called attention to the systematic value of the characters of the mouth-parts and of the tarsal appendages. Later Professor A. Berlese made use of some very important characters, the variations of the specialized setae on the palpal thumb. In 1900 Mr. N. Banks in his, "Red spiders of the United States," showed that the characters used by both of these authors were of special value in helping to separate our American forms. It is to Mr. Banks that we should give the credit for first straightening out many of the synonymous and wrongly determined species found in our country. But as yet, both in this country and in Europe, there is much confusion in regard to the identity and synonymy of some of our best known and most injurious species.

After examining hundreds of specimens from many parts of the United States, with magnifications up to 2000 diameters, and using an oil emersion lens, the present writer has found that the genital armature of the male is excellently adapted for systematic purposes.

The genital armature of the male may be considered as being composed of the penis, its attachments, and the slit-like opening through which it is protruded. For our purposes the penis alone

will be considered, as it is well chitinized, quite visible, and offers great variations among different species, while only a few exist among individuals of a single species taken from the same host plant.

GENERAL STRUCTURE OF THE PENIS AND EXPLANATION OF TERMS USED IN REFERENCE TO ITS PARTS. (See Figure.)

Inner lobe—The imbedded or attached part of the penis. It is much less chitinized than the penis proper.

Shaft—The free part of the penis. It is much more strongly chitinized than the inner lobe.

Basilar lobe—The enlarged proximal part of the shaft. It is not always present.

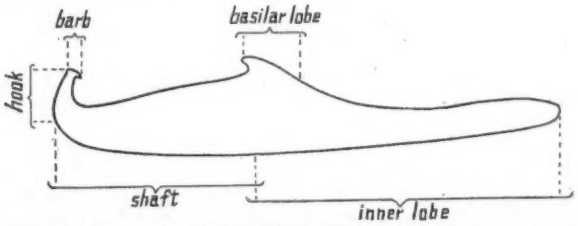

FIG. 1. Penis of male of **Tetranychus telarius** Linn., as seen from the right side, X 1800; showing the various parts delineated and labeled.

Hook—The dorsally curved distal part of the penis. It is frequently absent.

Barb—The flattened or knobbed or bent tip of the penis.

KEY TO THE MALES THUS FAR EXAMINED.

I. 1. Penis long, tapering, without hook.
  II. 1. Penis without basilar lobe; long, seta or spine-like.
    III. 1. Shaft less than 0.04 mm. in length, frequently doubly curved.....**T. weldoni** n. sp.
    III. 2. Shaft over 0.06 mm. in length, with but a single curve.....**T. longipes** Banks.
  II. 2. Penis with swollen part at the base of the shaft (basilar lobe).
    III. 1. Shaft strongly curved; without barb..**T. flavus** n.sp.
    III. 2. Shaft less curved; with flattened barb.....
T. borealis n. sp.

I. 2. Penis short, stouter, with hook.
  II. 1. Hook without barb.
    III. 1. Hook bent at an angle of from 30° to 50° to the axis of shaft.....**T. mytilaspidis** Riley
    III. 2. Hook bent at an angle equal to at least 90° to axis of shaft.....**T. pratensis** Banks
  II. 2. Hook with prominent, flattened, recurved barb.....
T. telarius Linn.

NOTES ON OLD SPECIES AND DESCRIPTIONS OF NEW ONES.

In these notes three new species are for the first time here delineated. Before long the writer hopes to publish complete descriptions of these together with illustrations of those structures having special systematic importance.

Tetranychus telarius Linn.
Acarus telarius Linn.—Fn. Suec., 481, No. 1974 (1761).

This species appears to have the following American synonyms:

Tetranychus sexmaculatus Riley (?)—Insect Life, Vol. II., p. 225. (1890).
Tetranychus 2-maculatus Harvey—Ann. Rep't. Maine Agri. Exp. Sta., part IV., p. 133, Pl. III. (1892).
Tetranychus gloveri Banks—The Red Spider of the United States. Tech. Ser. No. 8, Div. Entom., U. S. Dep't. Agri., p. 76. (1900).

This is our most common and most widely distributed species of red spider. It is also the most common species found in Europe. I give the following description of the penis of the male:

Penis short, stout. Inner lobe long, rod-like; longer than the shaft, and somewhat bent. Shaft thick, stout, short, much stouter at its base than at its distal end where it bears the prominent hook. Basilar lobe present, on the upper side of the shaft; it is small, protrudes slightly, and is hook-like in shape. Hook short, stout, extending dorsally; three or four times as broad at its base as it is at its apex; it forms an angle of over 90° with the apex of the shaft. Barb present at the end of the hook, flattened and recurved.

That our well known *T. 2-maculatus* Harvey is synonymous with *T. telarius* Linn. there can be but little doubt. I have sent specimens to Professor A. Berlese, of Italy, and after comparing them with the European species, he writes that they are the same. I have sent specimens to Dr. A. C. Oudermans, of Netherlands, and he states that they equal *T. telarius* L. I have received named female specimens of European individuals of *T. telarius* Linn. from Dr. Oudermans, which were collected from English elm (*Ulmus campestris* L.) at Amsterdam, October 1910. I have compared these females with the females of our *T. bimaculatus* Linn. I find in these specimens the presence of the same six bristles near the base of the tarsal pedicel of leg I. The four tenent hairs are similarly arranged and shaped in every respect as they are in our species. The tarsal pedicel is similar to our species. The tarsal claw is six cleft, and exactly like those I have examined in America.

In the case of the palpal characters I find the same claw, thumb, finger, and sense hair; and each with the same form, relative size, and position as in our species. The thumb also bears the same three bristles; and one of the terminal spines is present. I find difficulty in getting a specimen in the right attitude to show both of the terminal spines properly.

The females show the structures of the genital and anal areas to be the same as in our species. The plate in front of the vulva is the same, and has the common two bristles. The anal papilla is the same as in our species, and is flanked on each side by two bristles as in our species. These bristles are of the same size, and are situated as in our species.

In this country Mr. Banks and others have recognized a form which has passed under the name of *T. telarius* Linn. I have compared our American forms of *T. telarius* Linn. with our *T. bimaculatus* Harvey, and I will state that after examining hundreds of specimens of both supposedly distinct species from many States (East, West and Middle) in this country, I can find no structural difference between the two. Mr. Banks, in his "Red Spiders of the United States," represents the thumb of the palpus of *T. bimaculatus* Harvey as bearing but one distal digit, a long seta, and a basilar spine; the thumb of *T. telarius* Linn. as bearing three distal digits, two small setae, and no basilar spine. By means of treatment with chloral hydrate solution or other clearing agencies, and by use of magnifications of over 2000 diameters, I find that there are more appendages to the thumb in both cases than Banks has represented. I find in both cases that the palpal thumb bears a large stout digit at its tip, above this two small, diverging spines or digits. Near the base in both cases is the spine which Banks has figured for *T. bimaculatus* Harvey. Toward the tip of the thumb and below the big finger is a large, curved seta also shown in Banks' figure of *T. bimaculatus* Harvey. Behind the basilar spine I find in all instances two more prominent bristles not figured in either Bank's drawing of *T. bimaculatus* Harvey or his drawing of *T. telarius* Linn.! Also I find that the tarsal claw in both cases is six-cleft instead of being four cleft as stated in Bank's paper!

There are some other points which I should like to mention in regard to the synonymy of these two species, but for the present I shall stop with these.

Tetranychus sexmaculatus Riley may be the same as *T. telarius* Linn. I have received many specimens of this species, sent by Professor H. J. Quayle, from Southern California. I find that the females agree with the females of *T. telarius* Linn. in every minute detail of structure. I have transferred live individuals to the common host plants of *T. telarius* Linn. Here they have not thrived successfully. In most cases they would not establish themselves. Unfortunately I have never examined a male of *T. sexmaculatus* Riley, and since so much depends upon the characters of the male genital armature we cannot be sure of the synonymy of the two species until a male specimen is examined.

Tetranychus gloveri Banks appears to be the same as *T. telarius* Linn. I have received scores of individuals of *T. gloveri* Banks, on cotton, from Georgia, sent by E. L. Worsham. These agree in all respects with my specimens of *T. telarius* Linn. collected from many places in the United States, and with the specimens of *T. telarius* Linn. received from Europe. Professor A. Berlese has examined specimens of *T. gloveri* Banks from cotton, and has considered it as being the same as *T. telarius* Linn.

Tetranychus weldoni n. sp.

I have received many specimens of red spiders from G. P. Weldon labeled *T. bimaculatus* Harvey. For a long time I have considered that they were this species, which is, as I have shown, a synonym of *T. telarius* Linn. Recently I have found that the male is different from the male of the *T. telarius* Linn.

Female: Similar in all respects to the female of *T. telarius* Linn.

Male: Different from male of *T. telarius* L. in characters of penis and spur on palpus. Spur on palpus not so pointed as in T. telarius Linn. Penis very long, rod-like; equal to a third the length of the body. Inner lobe short, rod-like, slightly swollen at its anterior end. Shaft, rod-like, not setiform; gradually tapering as you pass backward; posterior one half turned upward; tip narrowly rounded, not pointed. Basilar lobe absent. Hook absent. Barb absent.

From Grand Junction, Colorado; on apple, prune, and cotton wood; by G. P. Weldon.

Tetranychus borealis n. sp.

Female: Similar to the female of *T. telarius* Linn. but smaller, and never orange or red. The inner prongs of the tarsal claw are stouter than the inner prongs of the tarsal claw of *T. telarius* Linn.

Male: Similar to the male of *T. telarius* Linn., except for the penis. Penis long, straight. Inner lobe about equal to basilar lobe in length. Shaft shaped like a slender rod. Basilar lobe very pronounced, cone-shaped, equal to about one fourth the length of the shaft. Hook absent. Barb knob-like.

From Coast Range Moutains, Benton Co., Oregon; on *Spirea* sp.; by the writer.

This form is very closely related to another species, the discription of which follows.

Tetranychus flavus n. sp.

For over a year I have been studying a form of red spider which is a serious orchard pest in Oregon. It especially is injurious to apples when they are growing above an elevation of 1000 feet above sea level. In Hood River Valley I have found this form so serious as to discolor the leaves of whole orchards of apples, and in some instances as to cause defoliation late in the summer. When fall comes and the trees drop their leaves, these mites all become a pale yellow in color and collect in masses about the trunks of trees and the cracks of the ground for a region of several feet from the tree bases. Here they pass the winter, and become active again in the spring when the trees put out their foliage. At first I considered this species as but a form of our common *T. telarius* L. After studying these two forms for two seasons in the laboratory, I find that they must be considered as distinct species. This species is even more closely related to the one just described, *T. borealis* n. sp. It may be described as follows:

General appearance similar to *T. borealis* n. sp.; also similar to *T. telarius* Linn., but the individuals are smaller. Color of immature forms green or yellow; of adults green or yellow, with black markings not pronounced. Adults are never orange or red. In the winter when deprived of food supply all instars yellow. General structures similar to those of *T. telarius* Linn., but the tarsal claw in most instances is only five-cleft, the two inner prongs being united. In *T. telarius* Linn., the tarsal claw is, I find, six-cleft; however, it has been represented by others as being four- cleft. In the case of the female of *T. flavus* the anal spines are situated farther forward than in *T. telarius* Linn., and also nearer the margins of the genital slit or opening. This species differs from *T. borealis* n. sp. in the tarsal characters which are nearer those of *T. telarius* Linn., and in having no barb to the penis.

The penis of this species is entirely different from the penis of *T. telarius* Linn. It is long and spine-like. In length it is equal to a third or fourth of the entire length of the body. Inner lobe of penis not prom-

inent, slightly swollen at its anterior end; in size, smaller than the basilar lobe of shaft. Shaft long, curved, and resembling the sting of a wasp; varying greatly in curvature, generally bending downward, then upward, or it may have but a single curve, or it might be straight. Basilar lobe, large, subcylindrical, equal to over one fourth of the total length of the entire shaft. Hook and barb absent.

Generally distributed over Hood River Valley, Oregon; on apple trees especially; observed and reported by many people. Found in some places in the Willamette Valley, Oregon; on apples; by the writer. Probably present throughout the Pacific Northwest above altitudes of 1000 feet.

Tetranychus pratensis Banks.

Tetranychus pratensis Banks—Proc. Entom. Soc. Wash., Vol. XIV, p. 97. (1912).

I have examined specimens of this species, and find that the tarsal appendages are very peculiar. I find that there are two claws as stated by Banks, but only one, the outer, is simple. The inner claw is bent downward very near its base, and beyond this bend it is three cleft. On each side of the tarsal claws is a short projection from which extends a pair of tenent hairs. The penis of the male may be described as follows:

Inner lobe slightly over one half as long as the shaft of the penis. Shaft stout, somewhat similar to the shaft in *T. telarius* Linn.; enlarged slightly at its base so as to form the basilar lobe. Hook pronounced; bent at an angle of about 90° to the axis of the shaft. Barb absent.

From Pullman, Washington; on timothy; by G. R. Hyslop.

Tetranychus mytilaspidis Riley.

Penthalodes mytilaspidis Riley—Hubbard, Orange Insects, p. 216. (1885).

This very characteristic red spider differs from most of our species in having the bristles of the body arising from prominent tubercles. In many respects it is about as far removed from *T. telarius* Linn. as any of the species of the genus. In the characteristics of the male genital armature it appears to be rather closely related to *T. telarius* Linn. The penis may be described as follows:

Inner lobe about one and a half times as long as the penis proper; not swollen at its anterior end. Shaft very short, and stout. A basilar lobe present in the form of a stout, more or less hook-like, protuberance on the dorsal side of the shaft. In this respect the penis is like that of *T. telarius* Linn. Hook very large, stout; bent at an angle of from 30° to 50° degrees to the axis of the shaft. Barb absent, but the distal part of the hook is bent out considerably.

Generally distributed in Southern California on citrus trees, also found on deciduous trees. A serious pest of stone and pomaceous fruit trees in certain parts of Oregon.

Tetranychus longipes Banks.

Tetranychus longipes Banks—Proc. Entom. Soc. Wash., Vol. XIV., p. 27. (1912).

This species is so different from most of the other species in the genus, that it might well be made the type of a new genus. It has strong affinities with the genus *Bryobia;* in the general shape of the body, in the length of the anterior pair of legs, in the possession of the horn-like setae at the anterior end of the cephalothorax. I have examined the tarsal appendages of leg I, and find that with 2000 diameters magnification they are very complicated, and do not consist of two simple claws as Banks states. There is one large simple claw to the tarsus. Above this and apparently fused with it is a chitinous projection with many parallel hairs forming a comb. On either side of the tarsal claw is a pulvillus-like structure, each of which has several projecting tenent or other hairs.

I have observed but one male specimen of this species, and this specimen was very much dilapidated. What I have taken to be the penis may be described as follows:

Penis very large and long; much longer than the penis of any other species examined. Inner lobe about one third as long as the shaft, broadest at its base. Shaft long, curved, seta-like. Basilar lobe, hook, and barb absent.

From Springer, New Mexico; on grass (*Agropyron*); by C. N. Ainslie. From Holtville, California; by Wildermuth.

A SYNOPSIS OF THE DESCRIBED NORTH AMERICAN SPECIES OF THE DIPTEROUS GENUS TIPULA L.

By W. G. Dietz, M. D.

The following synopsis is not offered to fill the proverbial long felt want, but rather that it may facilitate and lessen the labor of the student who undertakes the study of the above mentioned genus. It is based almost entirely on the original descriptions with the exception of those of Fabricius, and for these I have had to depend upon those of Wiedemann.*

Many of these fall short of completeness. Some, like those of Walker's, as was his custom elsewhere, are woefully defective. Fortunately not a few of these have been authentically recognized and wherever such was the case and representative material was at hand, I have drawn upon this source of information. It will readily be seen that this synopsis is not merely a synoptical table in the usual sense and hence, some explanatory remarks are deemed necessary. To give more certitude to the identification of a given species, the usual differential diagnosis is followed by a short detail description. In the latter, especial stress has been laid upon the structure and formation of the hypopygium—ninth segment—and the eighth abdominal segment of the male, though in many instances no information on these points was available. All references to the apical appendages of the male hypopygium have been omitted, important and almost absolute their consideration becomes in the separation of otherwise very closely allied or similar forms, as this would have led far beyond the scope of this paper. It must be remembered that all references to the eighth and ninth—hypopygium—abdominal segments refer to the male, unless otherwise stated.†

In the use of the synopsis, a certain margin must be allowed for the interpretation of terms used. I have, as nearly as possible made use of the identical language of the authors in their descriptions and in the translations from the Latin have kept close to the sense of the writer. What to one observer might

*Aussereuropaeische zwei fluegelige Insecten. Vol. I.

†The term "ninth tergite" and "ninth sternite" in the text are the equivalents of "upper and lower lamella," respectively, used by writers.

appear as a fascia, might merely be looked upon as a spot by another and vice versa. Under the heading, "Wings Spotted," species may have been included which might with equal propriety have been placed under "wings unicolorous" and the reverse. Whenever I have been conscious of such being the case, I have endeavored to remedy the difficulty by cross-references. To those who expect this synopsis to be an easy road to the goal, disappointment will come. To determine the relative position of a given form and then by close study of the original description and whenever possible, of the type, the student should be enabled with certain limitations, to determine whether a given form is described or not. To the critic this paper will furnish a rich field, more so perhaps, than the time and labor bestowed upon it should warrant.

Following the synopsis, I have added a list with habitat and bibliography of these species not contained in Prof. Aldrich's catalogue.

1. Wings normal in size in both sexes....2
   Wings reduced in size, or vestigial, at least in the female....165
2. Wings spotted or striped....3
   Wings unicolorous; at most, costal margin and stigma fuscous, or a white, hyaline spot before the stigma, more rarely another behind it; veins may be margined with fuscous....87*
3. Wings spotted, marbled or clouded....4
   Not as above, but the costal margin, fifth longitudinal vein and posterior cross-vein more or less broadly margined with fuscous, apex of wing frequently infuscate; generally a pale hyaline vitta in the second basal cell....79
4. With pale transverse fascia....5
   Without such a fascia....24
5. Wings conspicuously variegated with dark fuscous....6
   Wings not, or inconspicuously variegated with fuscous....15
6. Fascia behind the stigma....7
   Fascia before the stigma....10
7. Facia angulate....8
   Fascia not angulate....9
8. Joints of flagellum bicolorous. Yellow, thoracic vittæ gray; abdomen with dorsal stripe, ninth tergite narrowly emarginate in the middle; with two, rather sharp teeth from the middle of the posterior margin, lateral angles produced; ninth sternite very deeply and broadly divided; pleural plates distinct. Length 12-13mm. Eight sternite entire....*angulata* Loew
   Joints of flagellum unicolorous. Mesonotum with about six fuscous, somewhat irregular lines, the middle pair more widely separated anteriorly; abdomen trivittate; eight sternite entire; hypopygium medium-sized, ninth tergite with rather broad V-shaped emargination, its margin with several teeth; ninth sternite with V-shaped emargination; pleural plates distinct. Length 14-23 mm....*trivittata* Say

*There may be an indistinct fuscous spot over the origin of the praefurca. The whitish spot before the stigma is called ante-stigmal spot, in the text.

9. Fascia does not extend beyond the fourth posterior cell; joints of flagellum bicolorous. Brown; three mesonotal stripes, margined with darker brown; abdomen trivittate; posterior margin of ninth tergite with two triangular projections, between which is a deep, narrow U-shaped incision; ninth sternite with deep V-shaped incision; pleural suture distinct. Length 14-19 mm.....*aspersa* Doane

Fascia reaches the posterior wing margin; joints of flagellum fuscous. Brown; antennæ long; mesonotal vittæ very broad; abdomen trivittate posterior margin of segments yellowish; hypopygium small, ninth tergite with a small, ninth sternite with deep and rather broad incision. Length 12 mm. (♂).....*decora* Doane

10. Fascia V-shaped, broken; joints of flagellum not bicolorous. Brownish-yellow, mesonotal vittæ broad. Abdomen spotted, trivittate; ninth tergite tumid, posterior margin with broad crescent-shaped incision, in the middle of which is a small semi-circular incision; posterior margin of ninth sternite bearing a pair of leaf like appendages. Length 20 mm. (♂).....*albimacula* Doane

Fascia not distinctly angulate.....11

11. Joints of flagellum unicolorous; thoracic vittæ not margined.....12

Joints of flagellum bicolorous; thoracic vittæ margined; posterior cells 1-3 infuscate. Dark-yellowish; mesonotal vittæ broad; abdomen conspicuously trivittate. Length 14 mm. (♀).....*fuliginosa* Say

12. Posterior cells 1-3 more or less white. Gray; mesonotal vittæ broad; abdomen with three stripes; ninth tergite with median impression and slight incision; posterior margin of ninth sternite with a broad, blunt triangular process; pleural suture present. Length 17 mm.....
vittatapennis Doane
albovittata Doane sgn.

Posterior cells 1-3 not white.....13

13. Posterior margin of abdominal segments not paler. Brown; metanotum with three gray lines, margined with fuscous. Abdomen with dorsal stripe; ninth tergite with deep, broad V-shaped incision; ninth sternite with deep, very narrow incision. No pleural suture. Length 11 mm. (♂).....*cylindrata* Doane

Posterior margin of abdominal segments paler.....14

14. A white spot in middle of first basal cell. Yellowish; mesonotum with four brown stripes. Abdomen trivittate; eight sternite produced and narrowed behind, with shallow, rounded incision; hypopygium large, ninth tergite with a slight depression and two very small points; ninth sternite with shallow, rounded incision containing a pair of processes; nearly all the veins bordered with whitish. Length 17 mm...
spectabilis Doane

First basal cell without a white spot. Brown; mesonotum gray with five brown stripes; abdomen trivittate; ninth tergite with deep median furrow, posterior margin with small V-shaped incision; ninth sternite with broad deep incision containing two tumid processes. Length 18-25 mm.....*incisa* Doane

15. Apex of wings blackish; a broad whitish, subapical fascia. Yellow, thorax trivittate; abdomen with dorsal line and indistinct lateral lines. Length 15 mm. (♀).....*apicalis* Loew

Apex of wings not blackish.....16

16. Joints of flagellum bicolorous. Median vitta of thorax obsolete, lateral vittæ very distinct, fuscous; abdomen pale, last two segments and posterior margin of the remaining ones, dark fuscous; hypopgyium large, ninth tergite prolonged posteriorly into a median, laterally compressed, bladelike process; ninth sternite with broad V-shaped incision, prolonged anteriorly into a narrow slit, from the base of which project two long setæ. Length 9-12 mm.....*fasciata* Loew

Joints of flagellum unicolorous.....17

17. Antennæ wholly fuscous.....18

Antennæ not wholly fuscous.....19

18. Origin of praefurca fuscous; mesonotum with six brown stripes, median pair broad, conspicuous. Brown; lateral and posterior margin of abdominal segments paler; eight sternite with median, short, two lobed appendage; hypopygium small, elongate, ninth tergite with deep V-shaped incision; ninth sternite narrowly divided in almost its entire length. Length 11 mm. (♂).....*tristis* Doane

Origin of praefurca not fuscous; mesonotum with three dark stripes, each of which is divided by a light brown line. Brown; lateral margin of abdominal segments broadly, posterior narrowly paler; ninth tergite with deep, narrow V-shaped incision; no pleural suture. Length 13 mm. (♂).....*marina* Doane

19. A fuscaus spot at beginning of praefurca.....20

Without such a spot.....22

20. Wings brownish, darker towards the apex, a faint spot in first basal cell, a whitish spot in posterior margin of axillary cell. Yellow; mesonotum with four stripes; abdomen trivittate, lateral stripes faint; eight sternite produced and narrowed posteriorly; hypopygium large, ninth tergite produced into two long, somewhat flattened triangular processes; ninth sternite with lateral appendages and posterior margin with two small median ones. Length 17 mm. (♂) *armata* *Doane

Wings not so marked.....21

21. Yellow, a whitish spot beyond the stigma. Mesonotal vittæ more or less distinct; eight sternite semicircularly incised; ninth tergite divided by a median suture into two subrectangular processes; ninth sternite large, with downward projecting spatulate processes. Length 13 mm. (♂). 12 mm. (♀).....*derbyi* †Doane

Brownish yellow, no white spot beyond the stigma. Thorax with three brown stripes; abdomen with three distinct brown stripes, posterior margin of segments whitish; eight sternite with rounded incision of the posterior margin, lateral angles with triangular, hooked appendages; ninth tergite with broad, deep V-shaped incision; posterior margin of ninth sternite with broad U-shaped incision, containing a pair of tumid appendages. Length 15 mm. (♂).....*occidentalis* Doane

22. All posterior cells more or less white. Light brown; mesonotum with four rather broad vittæ; abdomen with broad dorsal vitta; eight sternite narrowed posteriorly, emarginate at apex; ninth tergite small with deep V-shaped incision and narrow median depression; ninth sternite almost divided by a deep, U-shaped incision, containing a pair of tumid appendages. Length 11 mm. (♂).....*acutipleura* Doane

Some or all posterior cells not tinged with white.....23

23. Gray, fourth posterior cell except its apex, occupied by a fascia-like spot,‡ first posterior cell with a spot in the middle and extreme apex white. Thorax whitish, vittæ slightly darker, not margined; abdomen trivittate. Length 14 mm.....*subfasciata* Loew

Brown, posterior cells not white; the white fascia extends from before the stigma through outer parts of basal cells to the posterior margin. Mesonotum quadrivittate; anterior margin of abdominal segments darker brown; ninth tergite short, broad, with inconspicuous median ridge, posterior margin slightly emarginate, lateral angles ending in short, downward projecting processes; ninth sternite with broad, rounded incision, lateral angles with two lobed appendages. Length 10 mm. (♂).....*incurva* Doane

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*see also 60.

†Would perhaps more properly be placed under species: "wings unicolorous, a large white spot before the stigma."

‡This spot can hardly be called a fascia.

24. Wings marked with pale and fuscous spots, or the latter only.....25*
Wings marked with pale spots only.....65
25. A spot at base of basal cells.....26
Without such a spot.....34
26. Thoracic vittæ margined with fuscous.....27
Thoracic vittæ not margined.....33
27. Joints of flagellum bicolorous; abdomen of female very much elongated. Abdomen with lateral stripes; hypopygium small, ninth tergite short, rather broadly emarginate, ninth sternite more narrowly emarginate. Length 15½ mm. (♂). 19-20 mm. (♀).....*langiventris* Loew
Joints of flagellum unicolorous.....28
28. Color cinereous.....29
Color brown.....32
29. Entire wing with dark fuscous and white spots.....30
Not so marked.....31
30. Fourth posterior cell almost entirely white; ovipositor serrulate beneath; abdominal stripes indistinct. Length 23-24 mm.....*tesselata* Loew
First and fourth posterior cells white at base only. Abdomen with fuscous dorsal vitta and lateral lines; hypopygium small; ninth tergite small. Length 17 mm.....*septentrionalis* Loew
31. Basal joints of antennæ yellowish-brown; abdomen yellowish with three brown stripes; wing veins, except in basal portion margined with fuscous. Length 30 mm. (♀).....*leucophæa* Doane
Basal joints of antennæ grayish-fuscous; abdomen yellowish fuscous, stripes indistinct; hypopygium rather large, ninth tergite rather broadly emarginate posteriorly, the emargination with a small excision in the centre; ninth sternite with large V-shaped incision. Length 15-17 mm.....*truncorum* Meigen
32. Thoracic vittæ very wide; pleura with indistinct, brown spots. Pleural suture of hypopygium present, though indistinct. Posterior margin of ninth tergite yellowish, with two black, triangular, downward projecting processes on its under surface; posterior margin of ninth sternite with deep, rectangular incision. Whitish spots in all the cells. Length 20-33 mm.....*pacifica* Doane
Mesonotum with six brown stripes; pleura gray with an oblique, brown stripe. Hypopygium without pleural suture or pleural plates; ninth sternite deeply and broadly emarginate. Length 20mm. (♂).....*subcinerea* Doane
33. Larger. Length over 20mm, testaceous.....*retorta* V. d. Wulp
Smaller, not exceeding 16 mm. Grayish black; posterior margins of abdominal segments yellowish. Hypopygium large, blackish, appendages yellowish. Wings grayish-fuscous, base of first and fourth posterior cells, whitish. Length 11 mm. (♂).....*ternaria* Loew
34. Thoracic vittæ margined.....35
Thoracic vittæ not margined.....52
35. Joints of flagellum unicolorous.....36
Joints of flagellum bicolorous.....47
36. A fuscous spot at end of longitudinal veins.....†37
Wings not so marked.....39
37. Larger, length 16 mm. and over.....38
Smaller, length 10 mm. (♂). Brown; ninth tergite with a broad crescent shaped emargination. Ninth sternite with a very deep V-shaped incision. Neither pleural suture or pleural plates present. Basal half of fifth vein broadly bordered with fuscous anteriorly. Length 10 mm. (♂).....*simplex* ‡Doane

*olympia, see under 93. unicincta, see under 138. Simulata pratorum, see Appendix.

† pubera Loew., see 57; rupicola, see 50, and abluta, see 58, belong here.

‡The female has rudimentary wings and should have been placed under 165—species with rudimentary wings in the female—.

38. Thoracic dorsum with two velvety black spots each side behind the transverse suture. Fuscous spot at beginning of praefurca well marked. Abdomen orange-yellow above. Hypopygium small; neither pleural suture nor pleural plates; ninth tergite with a small semi-circular emargination in its posterior margin; ninth sternite with deep, oval emargination. Length 33-36 mm.....*abdominalis* Say

Thoracic dorsum not as above. The fuscous spot at beginning of praefurca inconspicuous. Abdomen tawny with fuscous median stripe. Hypopygium of moderate size; ninth tergite broadly emarginate in the middle and narrowly incised laterally on its posterior margin; posterior margin of ninth sternite with a deep V-shaped emargination. Length 20mm. (♀).....*cammiscibilis* Doane
cantaminata Daum sgn.

39. One or more posterior cells at least in part white.....40

Posterior cells not at all white. Body blackish; abdominal segment tipped with pale. Wings brownish towards the apex, a white spot at the exterior margin, surmounted by a fuscous spot. Length 11 mm. (♀).....*parrii* *Kirby

40. First posterior cell only, white at base. Pale ochraceous. Hypopygium large, ninth tergite rounded, black. Length 11 mm. (♂).....
latipennis Loew

More than one posterior cell white at base.....41†

41. Lateral appendages of the ninth sternite (below the pleural appendages) without a lower pendulous, or claw like arm. Hypopygium elongated, posterior margin of ninth tergite produced in the middle in a short, broad three pointed downward-projecting tooth; ninth sternite broadly emarginate posteriorly, from the middle of which arise two long strap-like appendages. Length 18 mm.....*madera* Doane

Lateral appendages with a lower pendulous, or claw-like arm.....42

42. Lateral appendages with only two arms.....43

Lateral appendages with three arms.....45

43. Lower arm of lateral appendage slender, membranous, nearly straight. Hypopygium large, ninth tergite with two pendulous processes at its posterior margin. Abdomen with a fuscous stripe each side. All posterior cells more or less white. Length 11½ mm.....*fallax* Loew

Lower arm of pendulous appendage more strongly chitinized, claw-like, tip blackish.....44

44. Lower arm of lateral appendages short, broad, flat. Grayish brown; pleura with an interrupted brown line running from neck to base of wings; posterio-lateral margins of abdominal segments grayish. Eight sternite threelobed; posterior margin of ninth sternite with downward projecting, three toothed process; two long, slender blade like processes arise from the base of the incision of the posterior margin of the ninth sternite. Wings brownish with whitish hyaline spots in all the cells. Length 15 mm.....*rohweri* Doane

Lower arm of lateral appendages long, slender. Subtestaceous; first posterior cell almost entirely, fourth at base, white; ninth tergite without pendulous processes. Length 12-14 mm.....*grata* Loew

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*May not belong to the genus Tipula.

†The differentiation of the seven species under this heading, are based on the table given in Prof. Doanes' paper, entitled "Tipula fallax and others." Psyche Vol. XIII, pp. 160-166. In wing pattern, they, together with Tip. hebes, resemble each other very much and Tip. fallax of the West and Tip. hebes of the East may be looked upon as typical.

45. The two upper arms of lateral appendages consist of two small, subequal, spine-like processes. Brown; pleura hoary, a brown line running from upper angle of mesopleura to neck; abdomen yellowish-brown, darker posteriorly; ninth tergite about twice as long as wide, posterior lateral angles ending in short, blunt points; posterior margin of ninth sternite with a pair of long twisted, heavily chitinized processes. Wings brownish with a few indistinct, whitish spaces. Length 15 mm. (♂ and ♀).....*coloradensis* Doane

First and second arms of lateral appendages very different in size and shape.....46

46. The blade-like processes arising from the posterior margin of the ninth sternite long, slender, sinuous. Brown; pleura grayish, with a brownish line reaching from neck to base of wing; abdomen yellowish-brown with three interrupted, brown lines. Hypopygium much elongated; extreme tip of ninth tergite produced downward into two short, sharp, curved claws; posterior margin of ninth sternite deeply notched and provided with two long, slender, sinuous, blade-like processes. Wings brownish with several whitish, hyaline spots in nearly all the cells—wing pattern scarcely distinguishable from fallax—Length 15 mm.....*alia* Doane

The blade-like processes shorter, more triangular. Brown; abdomen with broad median and narrow lateral stripes; ninth tergite a little longer than wide, posterior margin with a pair of short, black, downward projecting processes; ninth sternite completely divided, from the incision arises a pair of rather long, thin, sharp-pointed, blade-like processes; bases of first and fourth posterior cells whitish, discal cell almost wholly white. Length 13 mm.....*neucomeri* Doane

47. First posterior cell white at base.....48

First and fourth posterior cells white at base.....49

First posterior cell not white at base.....50

48. Smaller, 13-15 mm., ovipositor not serrulate beneath. Yellowish; pleura spotted with brown. Hypopygium large, ninth tergite large, longer than wide, narrowed posteriorly, its apex with a strongly chitinized, black, downward directed short, toothed process; ninth sternite with deep narrow incision, containing two long, slender, pointed, sickle-shaped processes; the lateral angle of the incision with a long, pendulous process. Length 13-15 mm.....*hebes* Loew

Larger, 21 mm. Testaceous; abdomen with three fuscous stripes, lamellæ of ovipositor serrulate beneath. Wings grayish-fuscous, fourth and fifth posterior cells somewhat paler at their bases and along the vein separating the same. Length 21 mm.....*serrulata* *Loew

49. Color gray, median line of thorax not fusiform. Abdomen trivittate; wings grayish-fuscous, no white spots along posterior wing margin. Length 19½ mm.....*discolor* †Loew

Color yellow, median line of thorax fusiform. Abdomen trivittate, ultimate segments nearly black. Hypopygium small, ninth tergite very small, sub-orbicular; wings pale brown with about four whitish spots. Length 12 mm.....*canadensis* Loew

50. Longitudinal veins fuscous at tip; femora with a whitish band a short distance before the tip. Brown; pleura grayish brown, with an irregular line and spots dark fuscous. Ninth tergite somewhat tumid, margin reflexed and with a pair of inconspicuous, black edged teeth; pleural suture complete, ninth sternite almost hidden by eighth sternite posterior margin with two broad appendages. Length 25 mm.....*rupicola* ‡Doane

Longitudinal veins not fuscous at tip, femora without preapical white band.....51

*Type minus flagellum, joints of same may be unicolorous.

†Joints of flagellum toward the base pale brown, black at base, outer joints entirely dark fuscous.

‡Should have been placed under 37.

51. Dark cinereous; abdomen sordid testaceous, indistinctly trivittate, last two segments blackish, lateral margins of segments whitish. Hypopygium small, ninth tergite reniform. Wings grayish-fuscous, a small white spot at the posterior margin of the second basal cell, discal cell and base of fourth posterior cell indistinctly whitish. Length 14 mm. *centralis* Loew

Yellowish; thorax reddish; abdomen trivittate. Hypopygium moderately large, ninth tergite membranous posteriorly, deeply emarginate in the middle, sides deflected in the form of rounded lobes; ninth sternite entire, a somewhat ellipsoidal shaped process arises from its posterior margin. Wings strongly tinged with yellow. Length 10-24 mm. ..... *flavescens* Fabr

52. Joints of flagellum unicolorous 53
Joints of flagellum bicolorous 60
53. Color grayish 54
Color not grayish 57
54. Three white spots along the posterior wing-margin; middle thoracic vitta obsolete anteriorly. Abdomen testaceous, lateral margins and last segments fuscous; hypopygium subcarinate below; wings grayish. Length 9-13 mm. ..... *fragilis* ♂ Loew
suspecta ♀ Loew

Posterior wing margin without three spots 55
55. Scutellum and metathorax shining; former yellow with a brown line in the middle. Abdomen brownish yellow, hind margin of segments and interrupted dorsal stripe brown; hypopygium rather large, ninth tergite broader than long, posterior margin with a crescent shaped emargination; ninth sternite nearly completely divided; pleural suture almost extending to the anterior margin. Wings pale gray, veins of apical portion white margined. Length 7-16 mm. ..... *beatula* O. S.
Scutellum and metathorax not shining 56
56. Abdomen shining, sutures brown, wings with three clearly defined fuscous spots along the costal margin. Length 18 mm. .... *frigida* Walker
Abdomen trivittate; wings with three fuscous spots along the costal margin near the apex. Length 12 mm. ..... *resurgens* Walker
57. Pubescens of body very conspicuous. Testaceous; thoracic stripes not very distinct. Hypopygium very large; ninth sternite large, barbed at the posterior margin with golden yellow hair. Wings grayish fuscous, anterior branch of second longitudinal vein abbreviated; most of the veins margined with fuscous; all posterior cells white margined. Length 18 mm. ..... *pubera* *Loew
Pubescens of body not conspicuous 58
58. A whitish spot before and behind the stigma 59
Wings not so marked. Brown; mesonotum with four brown stripes; abdomen with lateral stripes, latero-posterior margins of segments yellowish; eight and ninth segments separated above by a deep furrow; lateral margins of ninth tergite drawn out into a blunt point posteriorly, ninth sternite divided by a deep quadrate incision. Veins in apical part of wing white margined, and tipped with fuscous; similar to commiscibilis (contaminata). Length 22 mm. (♀) ..... *abluta* †Doane
59. The white spot before the stigma extends to base of fourth posterior cell; abdomen trivittate 60
The white spot before the stigma does not extend to the posterior cells. Brownish yellow. Mesonotum with four broad, brown stripes; abdomen with broken, brown lateral stripe; ninth tergite with deep, median furrow and rather deep V-shaped incision, the apex of which bears a short triangular black tipped tooth; ninth sternite with broad, deep U-shaped incision which contains a pair of large, tumid yellow haired appendages. Veins with indistinct whitish border. Length 16 mm. ..... *californica*, Doane

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* Should have been placed under 37.
† Should have been placed under 37.

60. Yellow; mesonotum quadro-vittate. Hypopygium large, ninth tergite produced into two long flattened sub-triangular processes; ninth sternite produced laterally into rather long very acute triangular appendages. The white spot extends through the fourth posterior cell to the posterior margin. Length 17 mm. (♂).....*armata* *Doane

Brown; mesonotum with three brown stripes; pleura slate colored. Posterior margin of abdominal segments paler; posterior margin of ninth tergite depressed shining black with median, short blunt process; ninth sternite with rounded emargination, containing a pair of rather long, tumid appendages. Wings gray with three conspicuous, white spots. Length 15-23 mm.....*albonotata* Doane

61. Abdomen pale yellowish, posterior margin of segments dark fuscous... *fasciata* †Loew

Abdomen not so marked.....62

62. Gray; ovipositor with a large, oval piceous and shining shield above, terminated by two movable, lanceolate, serrated and ferruginous lobes; penultimate joint (of abdomen) with two long, slender spines beneath; length 21-22 mm.....*arctica* ‡Curtis

Not gray; ovipositor not so constructed.....63

63. Fuscous; abdomen ferruginous with two fuscous stripes; thorax with pale brown stripes. Wings brownish with several whitish spots and three fuscous spots near the costal margin. Length 16 mm. (♂)..... *platymera* Walk

Yellowish species; abdomen trivittate.....64

64. Thorax grayish, or yellowish gray; all the joints of flagellum bicolored. Hypopygium very large, pleural pieces greatly elongated, linear. Three or four fuscous spots near the anterior margin, fourth and fifth posterior cells partly white. Length 13-14 mm.....*macrolabis* Loew

Mesonotum light yellow with four brown stripes. Ninth tergite (♀) nearly concealed beneath the eight. Wings tinged with brown, a brown spot in the anterior margin of first basal cell, origin of praefurca and over the stigma, an incomplete whitish band before the stigma extends to base of fourth posterior cell. Length 19 mm. (♀) *varia* Doane

65. Joints of flagellum bicolorous.....66

Joints of flagellum unicolorous.....§69

66. Cinereous, thoracic vittæ distinct.....67

Yellowish, thoracic vittæ concolorous, indistinct; apical third of wing infuscate..... 68

67. White spots at end of veins; mesonotum with two brown lines, confluent anteriorly; wings dusky, three or four white spots along central veins, stigma margined white; abdomen blackish; apex of femora blackish. *maculalipennis* Say

No white spots at end of veins; thoracic stripes margined; abdomen yellowish-gray with three dark stripes, hypopygium small, ninth tergite small, ovate; ninth sternite absent (?). Wings pale fuscous with four pale spots; base of first and fifth posterior cells white. Length 14 mm.....*balioptera* Loew

68. The white spot before the stigma extends across the wing and attains the posterior margin. Hypopygium large, ninth tergite broadly and profoundly emarginate, the lateral angles extended into sharp points; ninth sternite nearly concealed by the large, protuberant eighth sternite, pleural plates present, small, the lower angle of the right pleural plate prolonged into a two pronged process. Length 17 mm. *speciosa* Loew

The white spot does not extend beyond the base of the fourth posterior cell. Smaller, and wings paler than in speciosa. Length 15-16 mm. *submaculata* Loew

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*See also under 20.

†See under 16.

‡Type specimens minus antennæ.

§Indistinctly seen in T. valida, Loew; antennæ wanting in T. versi-color.

69. Thoracic stripes not margined.....*70
Thoracic stripes margined.....76

70. Apical third of wing infuscate; yellowish-gray; abdomen trivittate, lateral margin and posterior margin of segments whitish; ovipositor with a semi-tubular process each side at base. The white spot in front of the stigma extends across the wing and attains the posterior margin; base of third posterior cell white. Length 19-20 mm.....
valida †Loew

Apical third of wings not infuscate.....71

71. Abdomen black or orange colored.....72
Abdomen not so colored.....73

72. Abdomen blackish, posterior margin of segments yellow. Black; hypopygium small, posterior margin of ninth tergite depressed with two median, longitudinal, shining black ridges; ninth sternite with a broad deep incision. Wings grayish-brown, rhomboidal, discal and fourth posterior cells almost wholly white. Length 14 mm. (♂).....
helvocincta Doane

Abdomen orange-yellow with three black, longitudinal stripes. Wings brownish, yellowish toward the costa, with about four whitish spots, first and fourth posterior cells whitish at base. Length 15½ mm. (♀)
versicolor ‡Loew

73. Posterior cells not at all white. Head and thorax blue-black; stripes of latter indistinct; abdomen brownish yellow, first segment black, with brown lateral stripes; ninth tergite with broad, deep, crescent shaped incision; ninth sternite with deep, V-shaped incision, almost separating the segment; pleural plates distinct. Wings with four indistinct, whitish spots. Length 16 mm. (♂).....*nigrocorporis* Doane

One or more posterior cells at least partially white.....74

74. Abdomen with median stripe. Brown; thorax with five stripes, § lateral pair confluent before and behind; a lateral black spot on each abdominal segment; whitish spots along costal border distinct, those of disc indistinct, a small brown spot near the tip. Length 20 mm.....
dorsimacula Walker

Abdomen without median stripe.....75

75. Posterior cells one and four white at base. Pale ochreous. Hypopygium moderate, ninth tergite short with two linear processes in the middle of the posterior margin, eight sternite protuberant, emarginate at apical margin and with lateral, leaflike process each side; ninth tergite with apical V-shaped emargination, pleural suture short. Wings grayish, apex a little darker, with about four not very distinct, whitish spots. Length 12 mm.....*pallida* Loew

First posterior cell only, white at base. Grayish; thorax grayish white. Wings with several whitish spots. Length 12 mm. (♀)....*ignobilis* Loew

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*T. impudica see 121.

†Mr. C. P. Alexander informs me that he has seen the type of T. valida, a female, in the Loew collection at Cambridge and that it is identical with specimens of T. calva, in my collection, determined as such by Prof. Doane. The type of the latter species was a male. Specimens of both species—determined as such by Prof. Doane and Mr. C. P. Alexander respectively—apparently agree in all particulars, except in coloration of the flagellar joints, which are distinctly bicolored in calva and nearly fuscous in valida. There is also a difference in the apical appendages of the two species. Loew does not mention the narrowly infuscate posterior transverse, and apical posterior of fifth veins.

‡Type, a female, minus antennæ.

§ In all probability it should read: thoracic stripes concolorous, margined.

76. Posterior cells one and four white at base. Yellowish; abdomen with three fuscous stripes; hypopygium small; ninth tergite nearly divided, lobes rounded, posterior margin of each bidentate, ninth sternite with deep V-shaped emargination, containing two hairy pendulous appendages. Wings brownish with about four conspicuous, whitish spots. Length 14½-18 mm. ..... *serta* Loew

Posterior cells one and four not white at base. 77

77. First and fifth posterior cells white at base. Brown, mesonotum with four brown stripes; abdomen with narrow lateral stripes; hypopygium small, ninth tergite terminating in a median, short and rather acute point. Wings grayish with faint, whitish spots, stigma surrounded by white, a large white spot covers tips of basal cell and base of discal and fourth and fifth posterior cells. Length 14 mm. (♂) ..... *subtenuicornis* Doane

First posterior cell only, white* at base. 78

78. Wing spots distinct, posterior margin of wing not white, legs rubust. Abdomen trivittate; hypopygium not large, ninth tergite short, broad, emarginate posteriorly, ninth sternite broadly and very deeply emarginate, the emargination filled by a membrane, from the posterior border of which arises a slender process which ends in two large, fleshy lobes, which are emarginate at the apex. Wings brownish, a large whitish spot, common to anal and axillary cells Length 14-22½ mm. ..... *angustipennis* Loew

Wing spots very indistinct, posterior margin of wings whitish, legs slender; thoracic vittæ subconfluent; abdomen with black median stripe; hypopygium large with two large, pendulous appendages. Length 7½ mm. ..... *appendiculata* Loew

79. Joints of flagellum unicolorous. 80

Same as all the joints of flagellum bicolorous. 81

80. Pleura without oblique, fuscous stripe. Brown; mesonotum with three grayish-brown fuscous bordered vittæ, abdomen with broad, interrupted, brown lateral stripes, lateral margins of ninth tergite produced into short, blunt points, posteriorly; all posterior cells margined with brown. Length 16 mm. (♂) ..... *fuluvilineata* Doane
graphica Doane

Pleura with oblique fuscous stripe. Yellowish; posterior border of abdominal segments whitish; discal cell subovate, first posterior cell without subhyaline stripe. Length 13 mm. (♂) ..... *subeluta* Johnson

81. Median vitta of wing attains the apex. 82

Median vitta of wing does not attain the apex. 85

82. Costal stripe sinuous posteriorly. Thoracic stripes not sharply defined; abdomen with lateral fuscous stripes; hypopygium small, ninth tergite rounded posteriorly with a rounded, median process terminating its posterior margin, ninth sternite with a very deep V-shaped incision; second posterior cell small, fourth and fifth white at base. Length 12½-16½ mm. ..... *bella* Loew

Costal stripe not sinuous posteriorly. 83

83. The hyaline vitta of the wing passes through the first posterior cell to the apex; abdominal segments without dark fuscous, transverse line before the posterior margin, the latter and lateral margin of segments paler. Length 14 mm. (♀) ..... *eluta* Loew

Hyaline vitta does not pass through the first posterior cell to the apex; dark transverse line before the posterior margin of the abdominal segments 84

*In the male of *angustipennis* this cell is frequently not white.

84. Larger, 20-28 mm; costal border broader and more deeply fuscous; the median vitta begins about the middle of the second basal cell, basal half of anal and axillary cells whitish hyaline. Hypopygium small, exposed part of ninth tergite short, posterior margin with a median broader and two lateral, clawlike processes, ninth sternite divided to near its base by a narrow suture, posterior margin sub-triangularly emarginate, the lateral angles end in a scroll-like protuberance, pleural suture present. Length 19-25½ mm.....*caloptera* Loew

Smaller, 19-20 mm. Costal border less intensely fuscous, the median vitta begins near the base of the second basal cell; anal and axillary cells grayish fuscous, slightly paler at the base. Hypopygium small, ninth tergite produced posteriorly into a large, lobelike process, almost as long as the exposed part of the body of the segment, ninth sternite deeply divided to near its base; pleural suture present. Length 14-20 mm.....*strepens* Loew

85. The white spot before the stigma extends across the wing in form of an irregular fascia and nearly reaches the posterior margin; part of costal border posterior to subcostal cell, paler. Length 13 mm. (♀).....*fraterna* Loew

The white spot does not extend beyond the base of the fourth posterior cell.....86*

86. Abdomen without fuscous stripes; hypopygium small, ninth tergite produced posteriorly into a large, lobe-like process, at each side of the posterior margin arises a pencil of long, stiff bristles, ninth sternite deeply and rather widely divided to near its base; pleural suture present. Length 12-20 mm.....*tricolor* Fahr

Abdomen with fuscous, lateral stripes. Length 15¼ mm. (♂).....*vitrea* V. d.Wulp

87. All the veins with a more or less distinct brown border. Gray, thoracic vittæ bordered with fuscous; abdomen fuscous; eight sternite distended by a tumid appendage on the ventral side of the ninth sternite, the latter with deep V-shaped incision and median suture; pleural plates present; posterior margin of ninth tergite with two close-set, black tipped projections. Wings almost hyaline with an indistinct whitish stripe in the first basal cell. Length 11 mm.....*meridiana* Doane

Not all the veins bordered with fuscous.....88

88. Posterior cross vein and apical part of fifth longitudinal vein narrowly bordered with fuscous.....89

Posterior cross vein and apical part of fifth vein not so marked.....94

89. Thoracic stripes margined with fuscous. Brown; joints of flagellum unicolorous, dark brown; abdomen with lateral fuscous stripes, hypopygium rather large, black, no pleural suture or pleural plates, posterior margin of ninth tergite with two slender processes. Ninth sternite with deep, broad incision and median yellow line. Wings almost hyaline, the indistinct whitish band in front of the stigma, extends to base of fourth posterior cell. Length 17 mm. (♂).....*albocaudata* †Doane

Thoracic stripes not margined.....90

90. Color yellow.....91

Color fuscous.....92

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*No mention of "a white spot before the stigma" is made by the author of T. vitrea.

†Specimens in my collection determined by Prof. Doane and agreeing with his description, show a well marked, strongly curved pleural suture.

91. Abdomen with more or less distinct fuscous stripes, lateral margins of segments broadly whitish. Joints of flagellum bicolored. Hypopygium large, eighth sternite truncate, the posterior margin with a median broad, rectangular process, lateral angles with a pair of long, rather narrow, flattened appendages; ninth tergite prolonged into two long, blunt processes; ninth sternite nearly concealed by the eight sternite; pleural plates distinct, but pleural suture nearly obliterated above. The white spot before the stigma extends to base of fourth posterior cell. Length 21 mm. (♂)..... *calva* *Doane

Abdomen not striped longitudinally, posterior margin of segments yellow. Joints of flagellum approximately unicolorous, brown; posterior border of eighth sternite emarginate with two bunches of reddish yellow hair; ninth tergite produced and narrowed posteriorly, posterior margin with crescent-shaped incision, with a median pair of short, black triangular downward projecting teeth; ninth sternite divided by a membranous area, posterior margin with two pairs of small appendages. Wings hyaline, the white antestigmatic band reaches almost to the posterior border. Length 11mm..*flavomarginata* Doane

92. Small cross vein margined with fuscous; flagellum dark brown; abdomen with two broad dark brown stripes, lateral and posterior margins of segments grayish; the posterior lateral corners of the ninth tergite drawn out into a short blunt process (♀); Wings almost hyaline, hypopygium similar to that of albocaudata. Length 19 (♀)..... *cognata* Doane

Small cross vein not margined with fuscous.....93

93. A spot over the base of the second submarginal and first posterior cells and a spot over the origin of the præfurca brown. Flagellum brown; mesonotum with four darker brown stripes, ninth tergite terminating into two short blunt processes. Wings with a brownish tinge. Length 15 mm. (♂)..... *olympia* Doane syn. *cancinna* Doane

Without spots over base of second submarginal and first posterior cells and over origin of prefurca. Joints of flagellum unicolorous; mesonotum with three brown stripes; posterior lateral angles of eight sternite with large appendages; posterior margin of ninth tergite with rounded incision, in the middle of which are two short, sharp points; ninth sternite divided by a deep, broad, U-shaped incision, containing a pair of pendulous appendages; pleural suture complete. Length 15mm. (♂), 23mm (♀)..... *ungulata* Doane

94. Wings with dark costal stripe.....95†

Wings without such a stripe, though costal margin may be a trifle darker than the rest of the wing.....99

95. Joints of flagellum bicolorous; costal stripe margined posteriorly by a subhyaline stripe. Abdomen dark yellowish, segments with a short, transverse fuscous line behind the anterior margin of segments 3-6 and a very small fuscous dot on the sides of all segments; hypopygium small, ninth tergite rounded posteriorly, impressed before and slightly notched in the middle of the posterior margin; ninth sternite compressed in its basal half into a carina; pleural suture distinct. Length 13-16mm..... *costalis* ‡Say.

Joints of flagellum not distinctly bicolorous, outer joints at least fuscous. Abdomen with fuscous stripe.....96

96. Costal stripe interrupted before the stigma by an indistinct hyaline spot. Length 19mm (♀)..... *cunctans* Say.

Costal stripe not interrupted.....97

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*See foot note on valida, under 70.

†T. clara probably belongs here. See 103.

‡Because *costalis* being preoccupied in the genus macramaxtix, Mr. C. P. Alexander has changed T. costalis to T. Sayi, a view which I cannot share, hence shall here retain Say's name.

97. Gray, posterior margin of abdominal segments grayish-brown. Hypopygium moderately large, ninth tergite broadly and deeply emarginate, the margin notched in the middle, lateral angles produced into a process, subtruncate at the apex, ninth sternite deeply divided by a U-shaped incision, the latter containing a medium lobe-like process, lateral margins of the incision emarginate, the upper angles bearing a long pendulous process. Wings light grayish fuscous. Length 14½-15½mm ..... *infuscata* Loew

Not gray, posterior margin abdominal segments not paler 98

98. Reddish yellow, smaller. Head and thorax whitish pollinose. Hypopygium very small, compressed. Wings pale fuscous, first basal cell and margin of second a trifle paler. Length 13mm (♂) ... *casta* Loew*

Brown, larger. Thorax gray with four brown stripes; posterior margin of eighth sternite† with a median tuft of yellow hair between a pair of irregularly shaped, six-sided, box-like appendages; ninth tergite with the posterior-lateral angles produced into two broad, truncate projections; posterior margin of ninth sternite with rounded incision containing a pair of horn-like projections. Length 16-20mm..... *flavocauda* Doane

99. A vitreous spot before the stigma 100

Without such a spot ..... 154‡

100. Spot lunate, extending to or beyond the discal cell 101

Spot small, never extending beyond the second longitudinal vein 145

101. Joints of flagellum distinctly bicolorous ..... 102§

Joints of flagellum approximately unicolorous 110

102. Fuscous species; abdomen with three darker stripes; eight sternite with a median process 103

Yellowish species, costal and subcostal cells yellowish 104

103. Costal and subcostal cells brown. Mesonotum with four darker vittæ; Posterior margin of abdominal segments paler; ninth tergite short, incised in the middle. Wings hyaline, anterior margin of anal cell fuscous, the whitish line before the stigma which extends into the base of the fourth posterior cell. very indistinct. Length 16-22mm ..... *pellucida* Doane.
clara ‖Doane, Syn.

Costal, subcostal and anterior margin of anal cells tinged with yellow. Mesonotum with three dark vittæ; lateral and posterior margins of abdominal segments paler; hypopygium small, ninth tergite with deep crescent-shaped incision, ninth sternite with deep U-shaped incision, which contains two long, tumid appendages. The white spot before the stigma reaches the extreme base of the fourth posterior cell. Length 20-27mm ..... *inermis* Doane.

104. Abdomen with three dark, fuscous stripes, valves of ovipositor short, blade-like 105

Abdominal stripes, if any, faint; if distinct, but one dorsal stripe 106

105. Posterior margin of ninth tergite with a short, rather broad, two pointed process, posterior margin of eight sternite with fringe of yellow hair and two strong, curved reddish bristles; ninth sternite with median depression, in which lie the tips of two short appendages; the white spot before the stigma reaches the posterior border of the discal cell. Length, 15-18mm ..... *megaura* Doane.

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* Probably the male of cunctans Say., and according to Osten Sacken, synonymous.

†Original description says, "tergite," evidently a misprint.

‡Not infrequently the space before or surrounding the stigma is paler than the general color of the wing.

§Antennæ of T. clara not described by its author.

‖Prof. Doane does not mention the antennæ.

Posterior margin of ninth tergite with a small, subquadrate median emargination, the external posterior angles extend as upturned, hornlike processes, ninth sternite nearly concealed by the eighth, bearing on each lateral posterior angle an incurved, clawlike process. The white spot scarcely reaches the extreme base of the fourth posterior cell. Length 12mm..... *bicornis* Loew Mss.

106. Thoracic vittæ and dorsal stripe of abdomen distinct; length 10 mm. *puncticornis* Macg.

Thoracic vittæ obsolete or indistinct.....107

107. Joints of flagellum fuscous, yellow at the base; a transverse fuscous line before the posterior margin of the abdominal segments; abdomen with lateral fuscous stripe; white ante-stigmal spot very distinct but extends as a very faint line to discal cell. Ninth tergite quadrate, posterior margin slightly emarginate in the middle with two central, digitiform processes; ninth sternite small; pleural suture present. Length 12-18 mm..... *tephrocephala* Loew

Joints of flagellum yellow, fuscous at the base; abdominal segments without transverse striae before the posterior margin; lateral angle of eight sternite with a single or a pencil of two or three setæ; lateral angle of ninth tergite ending into a sharp poiht.....108

108. Thoracic vittæ obsolete; posterior margin of abdominal segments gray; the white ante-stigmal spot does not enter the fourth posterior cell. Length 15 mm. (♂). Ninth sternite emarginate, the emargination containing two pendulous processes..... *translucida* Doane

Thoracic vittæ not obsolete, though indistinct; posterior margin of abdominal segments not paler.....109

109. The white ante-stigmal spot does not reach the posterior margin of the discal cell. Ninth sternite as in translucida, no white spot beyond the stigma. Length 16 mm. (♂)..... *cincticornis* Doane

The white ante-stigmal spot extends into the base of the fourth posterior cell. Ninth sternite as in translucida; a white spot beyond the stigma. Length 15-17 mm..... *cuspidata* Doane

110. Yellowish species 111
Brownish-yellow species 124
Grayish or fuscous species.....129
Blackish species (Northern).....142

111. The ante-stigmal spot does not extend into the discal cell. Mesonotum with three broad, dark brown vittæ; abdomen trivittate; eight sternite produced and narrowed posteriorly; ninth tergite very small, produced into two blunt processes posteriorly; ninth sternite large, lateral angles produced into long, tapering, twisted, hornlike processes. Length 13-14 mm..... *streptocera* Doane

The ante-stigmal spot extends into or across the discal cell.....112

112. Posterior margin of some or all abdominal segments paler.....113
Posterior margin of abdominal segments not paler.....118

113. Posterior margin of all the segments paler.....114
Some segments without pale posterior margin.....117

114. Abdomen with three well marked brown stripes. Mesonotum with five brown lines; joints of flagellum brown, darker at the base; lateral angles of eight sternite with two incurved reddish bristles; ninth tergite with deep broad, crescent-shaped incision; ninth sternite with deep V-shaped incision, below which is a whitish, oval process. Wings hyaline ante-stigmal spot very indistinct, but reaches the base of the fourth posterior cell. Length 18-22 mm..... *bisetosa* Doane

Abdomen yellow, darker posteriorly but without longitudinal stripes; flagellum brown; ninth tergite with deep V-shaped incision.....115

Abdomen reddish yellow, three indistinct stripes. *T. lamellata*, see 119.

115. Abdominal segments 6-8 mostly black. Mesonotum trivittate; ninth sternite with deep incision, containing a pair of yellow appendages; wings hyaline, a faint brown spot over origin of praefurca, ante-stigmal spot broad, distinct, reaches base of fourth and side of fifth posterior cell. Length 15-20 mm.....*retusa* Doane
Abdominal segments 6-8 not black.....116
116. Mesonotal stripes and ante-stigmal spot distinct. Eighth sternite very large with median, rectangular projection of the posterior margin; ninth sternite with deep U-shaped incision, containing a long, rather broad tumid process; pleural plates distinct; fifth vein narrowly bordered with brown. Length (♂) 22 mm.....*spatha* Doane
Mesonotal stripes and ante-stigmal spot very indistinct. Eighth sternite long, narrowed posteriorly; posterior margin of ninth sternite with two processes, each bearing a tuft of hair, lateral margins with two pairs of appendages. Length (♂) 12 mm.....*splendens* Doane
117. Ante-stigmal spot extends to posterior margin of wing; posterior margin of abdominal segments 1-7 pale yellow. Joints of flagellum brown, yellow at the base. Mesonotum with three broad, reddish brown stripes. Abdomen trivittate, segments 8-9 wholly brown. Wings nearly hyaline. Length (♀) 20 mm.....*albofascia* Doane
Ante-stigmal spot does not reach the posterior margin of wing. Abdomen with three stripes, posterior margin of segments 4-8 white; ninth tergite with deep, median impression bearing at its end a rather broad, sharp pointed process; ninth sternite with deep, white bordered incision which contains two pendulous appendages. Wings hyaline, a whitish spot beyond the stigma and two whitish, indistinct streaks just behind the sixth longitudinal vein. Length (♂) 19 mm. *albocincta* Doane
118. A whitish spot beyond the stigma. Joints of flagellum darker at the base; three broad mesonotal stripes; three indistinct abdominal stripes; lateral angles of eight sternite with a pair of rather broad appendages; ninth tergite thick swollen with median shallow furrow, posterior margin produced each side into a blunt, swollen process, deeply emarginate between the processes; ninth sternite with rounded incision which is filled by two long triangular appendages. Wings hyaline; the ante-stigmal spot extends into the base of the fourth posterior cell. Length 21 mm. (♂).....*hirsuta* Doane
Without whitish spot beyond the stigma.....119
119. Mesonotal vittæ obsolete or very faint; abdominal stripes and ante-stigmal spots ill defined or indistinct.....120
Ante-stigmal spots at least distinct.....121
120. Larger, 18-20 mm., thorax yellow, shining, no stripes. Flagellum brown; posterior margin of eight sternite* with two tufts of long hair; hypopygium large; posterior margin of ninth tergite with slight median incision, lateral angles produced into short, slender acute points; ninth sternite with rather deep incision containing a pair of short appendages. Wings hyaline.....*lucida* Doane
Smaller, 12-13 mm. Flagellum brown; thorax not shining, stripes very faint brownish. Ninth tergite nearly completely divided, each side terminating into a point, bent at right angle to upper surface. Ninth sternite long, posterior margin with two small processes, each bearing a tuft of hair. Wings hyaline.....*lamellata* Doane
121. Abdomen with three black stripes; ante-stigmal spot distinct; flagellum dark fuscous.....122
Abdomen without such stripes; thoracic stripes very faint; ante-stigmal spot distinct extending to base of fourth basal cell.....123

*In the description it says "tergite," no doubt by misprint.

122. Ante-stigmal spot extends into the bases of the fourth and fifth posterior cells, one or two irregular whitish hyaline spaces in anal and axillary cells. Mesonotum with four brown lines; posterior margin of abdominal segments gray; ninth tergite short, divided by deep median ncision; ninth sternite with deep, median incision. Wings with grayish tinge. Length 15-25 mm.....*impudica* Doane

Ante-stigmal spots extends into fourth posterior cell only; nó hyaline spots in anal and axillary cells. Mesonotal vittæ very distinct; ninth tergite rather short, with deep broad, V-shaped emargination; ninth sternite with triangular emargination, the anterior end of which is almost circular; eight sternite with nearly semi-circular emargination; pleural plates distinct. Length 13-18 mm..*praecisa* Loew

123. Joints of flagellum lighth brown, darker at the base; eighth sternite not emarginate. Ninth tergite with median furrow, lateral angles slightly produced; ninth sternite divided by a rather wide membranous portion, posterior margin with a pair of two parted appendages. Wings hyaline. Length 12 mm.....*rusticola* Doane

Joints of flagellum fuscous; eighth sternite with shallow, broad rounded incision. Hypopygium large, ninth tergite of moderate length, narrowly emarginate in the middle, apical margin of each side very slightly emarginate; ninth sternite widely and very deeply emarginate, with a broad, subtriangular process each side. Length 18 mm. *biarmata* Doane

124. Posterior margin of abdominal segments paler.....125

Posterior margin of abdominal segments not paler; abdomen more or less distinctly trivittate..... 126

125. Mesonotum yellowish with three broad brown stripes; median fuscous vitta of abdomen broad; posterior margin of eight sternite with two median short projections; median third of ninth tergite yellow, rest brown, with broad, deep incision and median depression; ninth sternite with very broad, deep U-shaped incision, lateral margin with a pair of short processes; pleural plates distinct, produced into a long, two pointed process; ante-stigmal spot indistinct and does not reach the base of the fourth posterior cell. Length 9-11 mm...*atrisumma* Doane

streptocera Doane, see under 111.
impudica Doane, see under 122.
fulvinodus Doane, see under 140.
albicincta Doane, see under 117.

126. Mesonotum with four brown stripes; eight sternite produced, not emarginate; with a rather broad, elongated round tipped flap; ninth tergite short, divided by a deep V-shaped incision; ninth sternite elongated, deeply incised, lateral margin with long, slender pointed process. Ante-stigmal spot broken, extends into base of fourth posterior cell. Length 19 mm. (♂).....*pyramis* Doane

Mesonotum with three or five brown stripes or lines; eight sternite emarginate at apex; ninth sternite deeply divided.....127

127. Ninth tergite small, bi-emarginate at the apex. Mesonotum with three brown stripes; scutellum yellow with median brown line; emargination of ninth sternite filled with two appendages, each terminating in a pair of backward projecting claws. Wings hyaline with slight brownish tint, stigma inconspicuous; ante-stigmal spot distinct, extends into the base of the fourth posterior cell. Length 18-27 mm. *planicornia* Doane

Ninth tergite broadly or deeply emarginate; ante-stigmal spot reaches the base of the fourth posterior cell.....128

128. Mesonotum with three broad, brown stripes; ante-stigmal spot distinct; abdominal stripes indistinct. Emargination of eighth sternite very broad, rounded; posterior margin of ninth tergite with broad and shallow emargination, the latter with yellow border and bearing in the middle a pair of blackish, triangular teeth; emargination of ninth sternite U-shaped and containing a pair of tumid appendages. Length (♂) 16 mm.....*sylvicola* Doane

Mesonotum cinereous, with three median brown lines and two lateral, broader brown stripes; ante-stigmal spot very faint. Emargination of eight sternite very slight, rounded; emargination of ninth tergite very deep, V-shaped, latero-posterior angles sharp-pointed; lower angle of pleural plates produced into a short, blunt point. Length 12-15 mm. ..... *biuncus* Doane

129. Posterior margin of abdominal segments paler.....130
Posterior margin of abdominal segments not paler.....137*

130. With whitish spot beyond the stigma.....131
Without such a spot.....133

131. Ante-stigmal spot extends through discal, fourth and fifth posterior cells to the posterior margin of the wing. Mesonotum cinereous with five brown stripes; three abdominal stripes, lateral one broader, base of first segment whitish; eight sternite produced, slightly emarginate at the apex; ninth tergite small with broad, V-shaped emargination bordered posteriorly by a yellowish, less coriaceous margin; ninth sternite deeply divided, lateral margin angulated in such a way, that the emargination is widest at the base and narrowed about the middle. Length 12-14 mm..... *usitata* Doane

Ante-stigmal spot does not reach the posterior margin; thorax trivittate. 132

132. Mesonotum light brown; abdomen with three longitudinal, brown stripes. Posterior margin of eight sternite broadly emarginate, the posterior margin with a fringe of thick, long, yellow hair; ninth tergite with narrow, median incision; posterior margin of ninth sternite whitish with deep median incision, on each side of which are two small appendages. Ante-stigmal spot indistinct, extends into the base of the fourth posterior cell, discal cell four times as long as wide. Length 13-14 mm..... *barbata* Doane

Thorax gray; abdomen without longitudinal stripes. Scutellum dark yellow; eighth sternite simple, not emarginate; hypopygium small, somewhat compressed laterally, ninth tergite small with V-shaped emargination; ninth sternite widely and very deeply divided and from the base of the emargination arises a median, digitiform, hairy process, directed horizontally backwards. Wings yellowish hyaline, veins brown, the ante-stigmal spot is inconspicuous and extends into the base of the fourth posterior cell. Length 10-14 mm..... *apopezoides* Johnson

133. Eighth sternite deeply divided; abdomen with three stripes.....133
Eighth sternite not emarginate.....135

134. The lateral margins of the eight tergite end in long, slender processes; a broad blunt process arises from the base of the emargination. Mesonotum with four brown stripes; abdominal stripes indistinct; ninth tergite terminates in two short, median blunt processes; ninth sternite with deep U-shaped incision. The ante-stigmal spot distinct, interrupted at the praefurca, extends into the base of the fourth posterior cell. Length 15 mm..... *calcarata* Doane

Lateral margins of eighth sternite do not end in long processes; from the emargination arise two tufts of hair; ninth sternite deeply incised.....135

135. Mesonotum with four distinct stripes; ninth tergite with broad, shallow emargination. Abdominal stripes indistinct anteriorly, lateral margins of segments gray. Ante-stigmal spot extends into the base of the fourth posterior cell. Length 15-21 mm..... *aequalis* Doane

Mesonotum with three brown stripes; ninth tergite with broad, deep V-shaped incision. Abdominal stripes more distinct; ninth sternite with broad, deep depression; pleural suture very short. Ante-stigmal spot indistinct, extends into the base of the fourth posterior cell. Length 9 mm. (♂)..... *alta* Doane

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*Except fulvinodus, see under 140.

136. Mesonotum with three broad stripes, posterior margin of eighth sternite with two short acute processes; posterior margin of ninth tergite with narrow median and two broader crescent shaped incisions; ninth sternite with deep U-shaped incision, containing two tumid appendages. Ante-stigmal spot indistinct, not entering the fourth posterior cell. Length (♂) 15 mm. ..... *subtilis* Doane

Mesonotum with four, rather broad stripes; eighth sternite with a median rather broad process. Ninth tergite short, incised in the middle; ninth sternite with deep and rather broad incision. Wings hyaline; costal, subcostal and the anterior margin of the anal cells and stigma, brown; ante-stigmal spot indistinct, extends into the base of the fourth posterior cell. Length 16-22 mm. ..... *clara* Doane, syn. *pellucida* Doane. (See also under 103.)

137. Small, 10 mm., general reddish-brown color; thoracic stripes obsolete.* Posterior margin of segments and last three segments of abdomen dark brown. Wings light brown, veins dark brown; ante-stigmal spot reaches the posterior side of the discal cell. ..... *jejuna* Johnson

Generally larger species, color fuscous or gray. 138

138. Whitish streaks in anal, axillary and 2-5 posterior cells; a fuscous spot on basal transverse vein. Mesonotum with four stripes; abdomen with three rather indistinct lines; posterior margin of eight sternite with a small appemdage, lateral angle with a pair of larger appendages; ninth tergite ending in two rather acute points. Wings brownish tinted, ante-stigmal spot extends into base of fourth and side of fifth posterior cells. Length 19-22 mm. ..... *unicincta* Doane

Wings without whitish streaks, no fuscous spot on basal transverse vein. 139

139. Eighth sternite incised. 140

Eighth sternite not incised; ninth tergite and ninth sternite deeply incised. 141

140. No white spot beyond the stigma; ninth tergite with two small crescent-shaped incisions. Brown; mesonotum with three broad brown stripes; scutellum and metanotum with narrow brown line; abdomen trivittate lateral margin of the emargination of the eighth sternite with a pair of broad, two pointed appendages; ninth sternite divided, posterior lateral angles with a pair of elongated appendages, which again are provided with a pair of slender, long, twisted and pendulous appendages. Wings with brownish tinge, ante-stigmal spot extends into the base of the fourth posterior cell. Length 19-21 mm. ..... *acuta* Doane

A white spot beyond the stigma, posterior margin of ninth tergite with Y-shaped incision. Mesonotum with three brown stripes each of which is divided by a gray line; abdomen trivittate, posterior margin of segments yellowish; ninth sternite with rounded incision, containing a pair of whitish appendages. Wings hyaline, ante-stigmal spot very faint, broken, extends into base of fourth posterior cell. Length 12 mm. ..... *fulvinodus* †Doane

141. Gray, mesonotum with three vittæ the median indistinct, a median yellow line from transverse suture to base of abdomen, anterior margin of segments of the latter paler. Hypopygium small. Wings hyaline, with slight grayish tinge, very faint lighter streaks in nearly all the cells, stigma surrounded by an indistinct whitish cloud, which is incompletely connected with a whitish spot in the base of the discal cell. Length 10-14 mm. ..... *dorsolineata* Doane

Fuscous; mesonotum with five, rather broad stripes, lateral ones connected anteriorly; abdomen trivittate; eight sternite large, posterior margin bearing two pairs of appendages; hypopygium large; incision of ninth sternite contains a pair of rather long, somewhat curved, tumid, pendulous appendages. Wings with light brownish tinge, ante-stigmal spot extends into base of fourth posterior cell. Length 14-17 mm. ..... *anstralis* Doane

*No stripes mentioned in the description.

†Should have been included under 125.

142. Antennæ long, reach base of third abdominal segment (♂); front and occiput with median black line.....143
Antennæ of male do not reach beyond the base of the abdomen; front and occiput without median black line.....144

143. Joints of flagellum of male very slightly constricted in the middle, three mesonotal vittæ, margined with black; abdomen with black stripe each side. A yellow stripe extends from below the humerus to base of wing and scutellum; margins of median thoracic vittæ widely diverging anteriorly; margin and lower side of scutellum yellowish; hypopygium large; eighth sternite with black hair; posterior margin of ninth tergite with a pair of conical, blunt processes. Wings pale gray, the ante-stgimal spot not connected with the discal spot; a spot beyond the stigma. Length 14-18 mm.....*strigata* Coq
Joints 4-7 of male flagellum, strongly constricted in the middle; lateral vittæ of mesothorax obsolete, the median stripe gray, bordered with black; Abdomen sparsely clothed with short, pale yellow hair, yellow with median black vitta; hypopygium rather small, eighth sternite with sparse, short yellowish hair; ninth tergite without apical processes. White spots of wing indistinct. Length 11-13 (♂) to 15-19 (♀) mm..... *cineracea* Coq

144. Thorax with many short white hairs on its dorsum; wing spots rather distinct. Abdomen black, thinly covered with short, pale yellowish hair; base of ventral surface at least, and sometimes the hind margin of some of the segments, yellow; ventral surface of eighth sternite with pale yellow hair; hypopygium and wing-spots similar to strigata. Length 12-15 mm.....*tenebrasa* Coq
Thorax without white hairs, wing spots indistinct. Mesonotal vittæ black. Abdomen black, hind margins of segments, except the first, and lateral margins yellow, sparsely covered with very short, yellowish hair; hypopygium small; hind margin of ninth tergite destitute of processes. Length 14 mm. (♂).....*gelida* Coq

145. Fuscous species 146
Colored otherwise 149

146. Abdomen striped 147
Abdomen without longitudinal stripes, posterior margin of abdominal segments paler* 148

147. Posterior margin of abdominal segments not paler, the three longitudinal stripes black. Mesonotum with six brown lines, the median stripes broad, laterals narrow. Eighth sternite with two deep folds or depressions; posterior margin of ninth tergite with two very small points; ninth sternite with median, whitish line, lateral angles with long, slender processes; wings hyaline, one or two indistinct, whitish peristigmal spots and a similar spot in the discal cell. Length 12 mm. (♂).....*stalactoides* †Doane
Posterior margin of abdominal segments paler, dorsal stripe paler. Antennæ wholly brown; mesonotum gray, three very broad fuscous vittæ; lateral margin of abdominal segments paler; hypopygium small, ninth tergite with median, short rectangular process, the lateral angles of which are produced into sharp, black points; ninth sternite deeply and narrowly incised; wings with brownish tinge, middle portion somewhat whitish-hyaline; ante-stigmal spot indistinct. Length 14 mm. (♂).....*diluta* Doane

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*Posterior margin of abdominal segments very indistinctly paler in dejecta Fab.

†Appears closely allied to cineracea, Coq.

148. Antennæ wholly fuscous; mesonotal vittæ margined. Eighth tergite scarcely visible except at the sides; eight sternite entire, not emarginate; ninth tergite with two short, blunt marginal teeth; ninth sternite with deep V-shaped incision. Wings light fuscous. Length 10-12 mm ..... *dejecta* Fab
fumosa Doane syn

Antennæ brown, basal joints yellowish; mesonotum with four brown stripes, not margined. Abdomen brown, basal segments yellowish; eight sternite very large, very slightly emarginate, lateral angles with irregular shaped appendages; ninth tergite large, the lateral angles produced into long, somewhat curved, hornlike processes, which are concave within; posterior margin between these processes with two acute, triangular teeth; ninth sternite divided by a deep, broad membranous depression; pleural plates distinct. Wings hyaline. Length 17 mm. (♂)..... *tergata* Doane

149. Head and thorax yellow. Joints of flagellum fuscous; mesonotal vittæ very faint. Abdomen yellow at base brownish posteriorly; eighth sternite produced; narrowed posteriorly, with shallow, broad emargination, lateral angles with a pair of conical processes, bearing a pair of long, curved bristles; ninth tergite with deep median furrow, posterior margin with a pair of short, broad, blunt teeth, ninth sternite with deep, shield-shaped incision the sides of which bear a pair of rectangular plates. Wings hyaline, stigma indistinct, brown; ante-stigmal spot faint. Length 18 mm. (♂)..... *bifalcata* Doane

Head and thorax not yellow..... 150

150. Head and thorax shining black. Antennæ wholly black; thorax margined with yellow; abdomen shining, sides and posterior margins of segments yellow, eighth sternite not emarginate, hypopygium small, ninth tergite small, short and almost concealed by the reflected, upper appendages; ninth sternite with suture-like incision, the posterior margin emarginate. Wings pale brown, ante-stigmal spot small but distinct. Length 9-16 mm..... *spernax* O. S.

Head and thorax not shining black..... 151

151. Head subfuscous, thorax paler; antennæ yellowish-brown, base of flagellar joints black. Lateral and posterior margin of abdominal segments paler; hypopygium small. Wings pale-brownish, stigma concolorous, ante-stigmal spot not very distinct. Length 13 mm.....
umbrosa Loew

Head and thorax ferruginous..... 152

152. Southern species; legs very long, thorax trivittate; posterior margin of abdominal segments paler. Length 16 mm..... *perlongipes* Johnson
filipes Walker syn

Northern species; legs not unusually long..... 153

153. Posterior margin of abdominal segments paler; base of abdomen not paler, the latter with broad dorsal stripe. Length 24 mm... *triplex* Walker

Base of abdomen pale, posterior margin of segments not, or indistinctly paler. Length 16-20 mm..... *duplex* Walker

154. Joints of flagellum distinctly bicolorous; yellowish species..... 155

Joints of flagellum unicolorous..... 156

155. Large form; outer joints of flagellum fuscous; thorax with five stripes. Posterior margin of abdominal segments paler. Wings pale tawny, irregularly colorless behind the costal border; veins dark. Length 16 mm. ..... *borealis* Walker

Very small; all the joints of the flagellum bicolorous. Mesonotal vittæ scarcely recognizable. Posterior margins of abdominal segments slightly infuscate, hypopygium small; ninth tergite relatively large, separated from the side pieces by a distinct suture, posterior margin slightly emarginate; ninth sternite with Y-shaped incision; eighth sternite rounded posteriorly, pleural suture present, straight. Length 6 mm..... *annulicornis* Say

156. Color yellow, gray or fuscous.....157
Color black; posterior margin of abdominal segments gray.....164
157. Basal joints of antennæ yellow.....158
Basal joints of antennæ not yellow.....161
158. Yellowish species.....159
Fuscous species.....160
159. Antennæ long, more than half the length of the body, thorax vittate. Abdomen brownish. Wings grayish, stigma pale brown. Length 14 mm..... *disjuncta* Walker
Antennæ less than half the length of the body; three vittæ of thorax as well as of the abdomen, faintly indicated; eighth sternite extending up on the sides and much produced posteriorly, posterior margin rounded, with lateral, membranous appendages; ninth tergite very large, posterior angle produced into a pair of thick, heavy, slightly curved horns, posterior margin with two broad, flattened teeth; ninth sternite almost concealed by the eighth, posterior margin biemarginate. Wings hyaline, costal and subcostal cells and stigma with yellowish brown tinge. Length 17 mm. (♂)..... *sternata* Doane
160. Abdomen with broad dorsal stripe, basal part of ninth sternite with prominent carina. Mesonotum with faint trace of two cinereous lines; posterior margin of abdominal segments gray; hypopygium small, posterior margin of ninth tergite with crescent shaped incision; ninth sternite with crescent shaped incision. Wings with brownish tinge, subcostal cell and stigma slightly darker brown. Length 13-16 mm. *carinata* Doane
Abdomen with lateral and ventral stripes; ninth sternite not carinate. Mesonotum with three indistinct vittæ; posterior margin of abdominal segments paler; ninth sternite ending in two short, blunt points; ninth sternite with deep incision, containing a pair of long, membranous appendages. Wings with slight grayish tinge, stigma and veins brown the fifth posterior cell is not in contact with the discal cell. Length 13-15 mm. ..... *sulphurea* Doane
161. Gray species 162
Fuscous species 163
162. Thoracic stripes margined; lateral and posterior margin of abdominal segments margined with yellowish. First antennal joint gray. Hypopygium medium sized; ninth tergite large, convex, narrowed posteriorly and terminating into a short, rounded process; ninth sternite very large, protuberant, narrowly divided, subcarinate in its basal half, about the middle of the incision is a slight protuberance, densely covered with short hair; pleural suture nearly straight, evavescent posteriorly. Wings pale brownish, somewhat infuscate at the apex, veins and stigma brown. Length 8 mm. (♂)..... *cincta* Loew
Thoracic stripes not margined, lateral ones ill defined; abdomen with fuscous dorsal and ventral stripe. Head and thorax more or less clothed with pale, erect soft hairs. Hypopygium small. Wings with whitish tinge, veins and stigma brown. Length 9-13 mm.... *besselsi* O. S.
163. Head with two small, tumid processes just above the base of the antennæ; abdomen with three dark fuscous stripes, posterior margin of segments paler. Mesonotum gray with five fuscous stripes. Hypopygium small, ninth tergite with U-shaped incision; ninth sternite with deep narrow incision. Wings with grayish tinge, somewhat darker along the veins and in the middle of the cells, stigma brown, praefurca short. Length 10-14 mm..... *biturberculata* Doane
Head without processes, dorsal abdominal stripe, if at all, very faint. Antennæ rather long; mesonotum with median black line and two lateral indistinct, paler lines. Eighth tergite concealed except laterally; hypopygium very small, ninth tergite with wide, crescent shaped incision; ninth sternite with lateral appendages. Wings uniformly reddish-brown, stigma concolorous, veins brown. Length 9-10 mm. (♂). *illustris* Doane

164. Abdomen with distinct, reddish brown dorsal stripe, lateral margins of segments not paler. Mesonotum with three gray vittæ, median indistinct. Hypopygium small, ninth tergite with a broad lobe on each side of the posterior margin; ninth sternite with deep narrow incision, with two pairs of broad appendages. Length 13-15 mm...*rostellata* Doane

Abdomen not striped, lateral margin of segments gray. Head and mesonotum velvety black, latter with four rather indistinct grayish lines. Hypopygium small but rather long, ninth tergite deeply incised; ninth sternite with very deep, broad incision. Wings with grayish tinge stigma brown, veins brown, except at base of discal and second submarginal cell where they are white. Length 11-15 mm...*cervicula* Doane

165. Wings of the male normally developed.....166

Wings of both sexes* reduced in size or rudimentary.....167

166. Wings of female about one half the size of those of the male. Brownish-yellow; basal three joints of antennæ yellow, remainder dark brown; mesonotum vittate; abdomen with three darker stripes; eighth sternite somewhat crescent shaped, lateral margin with subtriangular appendages; posterior margin of ninth tergite somewhat crescent shaped; ninth sternite almost divided by a deep narrow, U-shaped incision; pleural plates present. Wings hyaline with smoky tinge; a whitish, ante-stigmal spot extends into the base of the fourth posterior cell; a whitish spot beyond the stigma. Length 16-20 mm.; of wings, male 18 mm., female 10 mm.....*Williamsi* Doane

Wings of female much more reduced.....*simplex*† Doane

167. Wings greatly reduced in size but retaining the wing-form; 4-9 mm. long..168

Wings reduced to mere irregular shaped pads, less than one half the length of the halters.....169

168. Brownish yellow, thorax light yellow, stripes yellow (often indistinct). Antennæ brown, basal joints yellow; abdomen with dorsal, lateral and ventral stripes; eighth sternite with broad, shallow median incision, lateral margin with broad subtriangular plates; ninth tergite with broad, circular incision with two short, median triangular processes. Wings distorted, variable in size, veins crowded. Length, male, 15 mm.; wing 5-9 mm.; female, 22 mm.; wing 5-6 mm....*vestigipennis* Doane

Cinereous, thorax cinereous with four rather broad, brown stripes. Antennæ brown, basal joints yellow; abdomen with dorsal and lateral stripes. Wings much reduced in size (♀), but little longer than the halters. Length 26 mm. (♀); wings 4 mm.....*sylvestra* Doane

169. Brown; antennæ wholly brown; thorax with median darker stripe; halters rather long and slender; abdomen with broad dorsal stripe; hypopygium rather small, ninth tergite with median groove and with deep, broad U-shaped incision containing two short sharp processes; ninth sternite almost completely divided by a narrow deep, V-shaped incision. Length 4-6 mm.....*quaylii* Doane

APPENDIX.

The following two species were not included in the synopsis:

T. pratorum Kirby.

Head and thorax slate colored, the latter with four brown stripes; antennæ fuscous, scape yellow. Abdomen yellow, with a fuscous dorsal stripe; hypopygium black. Wings subfuscous, clouded with white in the male, one or two fuscous spots near the anterior margin, stigma black, 24mm.

Wings of female not clouded with white.

T. simulata Walk ♀.

Fuscous, palpi and antennæ black, the latter about one-half the length of the thorax, fuscous, scape tawny, stripes indistinct. Abdomen dull testaceous with fuscous stripe. Wings hyaline with several brown spots, which are darkest along the costa. 20mm.

*Male of sylvestra not known.

†See under 37.

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biuncus Doane. Annals Ent. Soc. of Am., Vol. V, p. 58. Southern California.
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derbyi Doane. Annals Ent. Soc. of Am., Vol. V, P. 47. Stanford University, Cal.
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incurva Doane. Annals Ent. Soc. of Am., Vol. V, p. 43. Nebraska.
jejuna Johnson. Prof. Boston Soc. Nat. History, Vol. XXXIV, p. 132. Wellesley, Mass., Riverton, N. J.
madera Doane. Psyche. Vol. XVIII, p. 162. Carte Madera Creek, near Stanford University; Stanford University.
marina Doane. Annals Ent. Soc. of Am., Vol. V, p. 44. Palo Alta, Cal.
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nigrocorporis Doane. Annals Ent. Soc. of Am., Vol. V, p. 45. San Diego, Cal.
occidentalis Doane. Annals Ent. Soc. of Am., Vol V, p. 59. San Diego, Cal.
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quaylii Doane. Psyche. Vol. XVI, p. 18. Yuba City, Cal.
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SOME PEMPHIGINÆ ATTACKING SPECIES OF POPULUS IN COLORADO.

By C. P. GILLETTE.

Thecabius populimonilis Riley.

This species was described by Dr. Riley, who recorded it from Greeley, Colorado, and from southern Kansas. He described the alate female of the second generation taken during July, and said that it always occurred solitary in the galls. The description fits the examples that we have taken during the same month.

Thomas in his *Eighth Report as State Entomologist of Illinois*, page 205, copies Riley's description, but adds nothing to it.

Oestland in his *Synopsis of the Aphididæ of Minnesota*, page 24; and Packard in his *Forest Insects*, page 434, list this species.

Cowen in Bulletin 31, Colorado Experiment Station, page 116, listed this species as occurring at Fort Collins and Hotchkiss in Colorado, the latter place being on the western slope of the Continental Divide. Cowen also stated that only one louse seemed to reside in a gall.

Hunter lists this species in his *Aphididæ of North America*.

In the *Journal of Economic Entomology* for 1909, page 356, the writer recorded what seemed to be this species infesting the margins of the leaves of *Populus trichocarpa* at Portland, Oregon, and observed that there was but a single large louse in each gall, all of which were becoming winged, and that the young of these lice were migrating to the young leaves as soon as born, where they were forming new galls for themselves.

In 1910, the University of Nebraska published a manuscript on the "Aphididæ of Nebraska," which included notes on this family prepared by the lamented Thomas Albert Williams, which again copies the original description and extends the range of this species to Squaw Canon, Sioux County, Nebraska, and credits Professor Bruner with recording the species in Idaho and Utah.

Dr. Edith M. Patch, in Bulletin 213 of the Maine Experiment Station (June 1913) has extended the habitat of this insect to the cotton woods of Maine, where she has taken the galls and their inmates upon the leaves of *Populus balsamifera*.

In this Bulletin Dr. Patch has evidently overlooked the fundatrix or stem-mother and her gall, and has described an apterous second generation female instead.

The fundatrix of this species is undescribed and apparently has been unrecognized until the present year (1913).

On June 4, 1910, Mr. L. C. Bragg took a leaf of *Populus angustifolia* bearing the fundatrix gall, but its identity was not suspected until the gall (Plate I, figure 1) was discovered by the writer the past summer and associated with the production of the galls at Manitou and Colorado Springs on June 25th. At these places the galls were taken just as the second generation lice were beginning to leave the galls, which they do soon after birth, to go in search of the very young tender leaves at the tips of the twigs, upon which they locate, one in a place, along a line about midway between the midrib of the leaf and one of its margins, on the under side. The small galls on the tender new leaves were first seen, and a search for the source of the lice producing them resulted in the discovery of one of the pocket-like galls containing the fundatrix and a few of her newly born young, on a full grown leaf well down on the stem. This quickly solved the mystery as to the source of the lice that were producing the galls on the tender new leaves. In the next two hours a handful of these galls with their inmates were collected, and they were located in nearly every case by first finding the galls on the terminal leaves. At this time, most of the stem mothers had not begun to give birth to the young gall makers at Manitou.

The fundatrix gall, Plate I, figure 1, is very similar to the somewhat smaller galls of the later generations, (figures 9 and 10) averaging about 10 mm. in length, and is closed except for a narrow longitudinal slit opening below, which allows the young to escape as they are born. None of these young stay to feed with their mother in the gall.

Description of Fundatrix, Plate I, figure 2.

General color, slatey gray, due to a white powdery covering everywhere upon the surface of the body, without cottony threads, or with a few, only, about the lateral and posterior margins of the body. Beneath the powder, the body is of a dull, yellowish, olive green; head legs and antennæ blackish; body about 3.50 long by 2.25 broad; antenna (figure 3), .52; hind tibia, .45, hind femur, .55; beak very short, not attaining the second pair of coxæ; joints 3 and 5 of the antenna sub-

equal; joint 4 shortest; joints 1 and 2 and 4 about equal; 1 and 2 together about as long as joint 3; permanent sensoria only, and these are surrounded with cilia.

Described from specimens taken at Manitou and Colorado Springs, Colorado, June 25, 1913, by the writer.

Alate Fundatrigenia.

This seems undoubtedly to be the form originally described by Dr. Riley, and is distinguished by the sensoria of the antenna in his drawing. Riley shows three transverse sensoria on joints 4 and 5, and this is the common number in the examples we have had for study, while in the later and smaller winged sexupara there are usually no sensoria on joint 5 but the permanent one. On joint 3 (figure 4) there are from six to nine, usually seven or eight, sensoria present and there are three to four, usually three, on joint 4; two to four on joint 5, but usually three; none but the permanent sensorium on joint 6; and a well developed spine near the base of joint 3. Our examples differ from those described by Riley by being somewhat larger, as indicated by the alar expanse, which, in our examples, varies little from 9 mm.; and in the length of the body, which, in our examples, measures from 2.75 to 3.00.

The Apterous Fundatrigenia.

What I take to be this form are light cinnamon brown in color with head and tarsi black and with more or less darkened antennæ and legs. Length, 3.00; width, 1.90; antenna, .60; hind femora, .55; tibia, .45; beak very short, not reaching the second pair of coxæ; joints 1 and 2, and 4 and 5 of the antenna (figure 6), sub-equal; joint 6 longest; joint 3 nearly as long as joint 6 without the spur; joints 4 and 5, swollen and somewhat bead-like in appearance; permanent sensoria with cilia about their margins.

Described from specimens taken in the foothills near Fort Collins from July 19th to August 14th, and at Manitou August 9th.

On August 9th, I spent the day at Manitou studying this louse. The mature galls that were occupied were found inhabited in each case by one apterous female, probably a *fundatrigenia;* a few, 6 to 10, growing larvæ and pupæ, and a small number of first instar lice; some of the last were migrating to terminal leaves and forming new galls just as the young from the stem-mothers did earlier in the season. The partly grown lice that were staying with the gall-mothers seemed all to be developing into winged individuals. All that were half grown or more gave plain evidence of this, and in one gall I found a winged adult with the apterous mother and numerous pupæ and young lice. The alate louse was a sexupara and is like the many mounted specimens that we have of this form taken in former years and again this year, late in the season.

After about the 10th of August, these alate sexupara have been common in the galls at Boulder, Fort Collins and Manitou, being still common in the galls at the last named place as late as September 20th, when there were still many larvæ and pupæ.

It is difficult to account for all the gall-mothers being apterous in August and September, when we thought that all we had noticed early in the season were winged or pupæ and solitary in the galls. Probably the explanation is that the late part of the second generation, the young from the stem mother, were apterous and remained to give birth to the two forms that occur in the galls from about the last of July on through the summer. These apterous gall mothers are certainly the parents of the alate forms (sexupara) that develop with them in the galls during August and September. The young larvæ were still producing galls at Manitou, August 9th and I found very young galls as late as September 20th at Manitou this year.

Late Apterous Form.

Described from specimens taken at Boulder, August 31, 1913, by L. C. Bragg, and at Manitou, September 20 by the writer.

Upon some of the sprigs brought from Boulder young lice were still locating on tender new leaves at the tips of the twigs for the formation of new galls, though on most of the twigs terminal buds had formed. Most of these galls contained a single apterous female that was readily distinguished from the other lice in the gall by its being more orange yellow in color. I found from eight to fifteen lice in each gall, staying with their apterous mothers. The former were in many instances, adult, and always winged when fully grown, and were also all sexupara. These gall mothers were still giving birth to a few of the dark colored young that migrate from the parental gall to form new galls on the tender leaves.

The adult apterous females in these galls were different from those found at Manitou and Boulder earlier in the year, by being much smaller and by having five jointed antennæ (figure 7) instead of six in all of the many specimens examined, the fourth joint being short and bead-like, and the entire antenna very much resembling the antenna of the fundatrix. The earlier form also showed a tendency to combine joints 3 and 4 and become 5-jointed. Length of body, 1.80; antenna, .38; joint 3 as long as joint 5 with the spur; otherwise like the earlier form.

Sexupara.

This form is rather markedly different from the **Fundatrigenia** by being distinctly smaller by having fewer sensoria on the antennæ (figure 5) and by having several lice living together in a gall along with the apterous mother just described.

Length of body, 1.75 to 2.00; wing, 2.60; antenna (figure 5), .60; sensoria:—joint 3, from 4 to 7, but nearly always 5; joint 3, 2 to 4, but nearly always 3; joints 5 and 6 with permanent sensoria only; joint 3, slightly longer than 6, but not as long as joint 6 with the spur included; joints 4 and 5 about equal, permanent sensoria ciliated; sensoria on short transverse lobes or ridges which do not extend nearly around the antennal joints; spur on joint 3 rather weak.

Sexuales.

The alate sexupara begins giving birth to the sexual forms soon after leaving the galls. Those that escaped from the galls collected August 31st, had given birth to many males and oviparous females in the breeding cage September 1st. The females are greenish in color and measure about .90 in length; the males are pale yellow in color and measure about .60 in length; neither have beaks with which to take food; about 4 to 5 of each are born from one female.

The fact that this species is on the cotton woods from the time of formation of the stem mother gall early in the summer until the developement of the sexupara, it seems strongly probable that this species has no alternate host plant. The sexuales must be deposited upon the cottonwood or the stem mother could hardly be upon the leaves of these trees early in the spring.

SUMMARY OF LIFE HISTORY.

From all the data that we have been able to gather to the present time it seems probable that the life history of this species is about as follows:

The fundatrix hatches upon the cottonwood in the spring from eggs deposited upon these trees the previous fall. These stem mothers locate between the midrib and the margin of one of the early developing leaves and produce almond shaped galls similar to those that are produced on the terminal leaves, by their descendants, later in the season. From this stem-mother gall, the young escape almost as soon as born and locate on the tender new leaves, as did their mother, between the margin and midrib, each louse being solitary and producing an almond shaped gall. Apparently the lice of this second generation all become winged at first, it is certain that many do, and leave the galls, while a portion, especially of the later lice that are born, remain apterous, stay in the galls, and give birth to a third generation. These young, like the young from the stem mother, also migrate to the new leaves to continue the production of galls, each of which harbors but one louse at first, but a portion of the young of this brood remain with the mother in the gall

and become winged sexupara, of which ten to twelve may be found in a single gall with the parent. These winged sexupara begin to emerge in the vicinity of Fort Collins about the first week of August and continue to emerge till the last of September and soon give brith to the sexual forms.

The apterous females (*fundatrigenia or virgogenia*), occur in leaf galls, at least from about July 17th to September 20th, a portion of their young also staying in the galls with them and becoming sexupara, and a portion migrating as soon as born to form new galls, as late as September 1st. If this interpretation is correct, the alate fundatrigenia in this species seems only to distribute the species from one tree to another, but we have no observations that fully confirms this hypothesis.

The Galls. (Figures 1, 9, and 10.)

Throughout the summer the galls are started upon the very tenderest young leaves only, by first instar lice which locate on the ventral surface of the leaves. There may be from one to a large number of these galls on the leaves, the entire surface of the leaf being included in gall development very often when the lice are abundant. The galls are paler green than the remaing portions of the leaves; are long oval in general form; commonly 6 to 8 mm. in length, but may be as long as 10 mm., and always upon the upper or dorsal surface of the leaf.

While it is common to find these galls abundant upon the narrow leaved cottonwood, *Populus angustifolia*, in Colorado, we have never taken one of these galls on any of the several varities of broadleaved cottonwooods which are more common. It is entirely possible, therefore, that the specimens recorded in this paper from other states may belong to a distinct species. The galls sent from California by Professor E. Bethel, George P. Weldon, and A. C. Maxson; from Maine by Doctor Edith M. Patch; from Michigan by Professor R. L. Pettit, and those taken by the writer at Portland, Oregon, were all from broad leaved cottonwoods. On the broad leaved cottonwoods, the galls are usually placed near the leaf margin so that the long diameter of the gall is parallel with the leaf margin.*

*Since writing the above paper Mr. George M. List has collected additional material of this species for me at Manitou, on October 18th. Some of the galls taken on this date still contain the virgogenia and alate sexupara as described above and many sexual males and females. Probably it is only the belated sexupara that deposit their sexual young in the galls. This completes the round of development on the cottonwood except for the egg stage, which doubtless occurs on this tree, also.

The specimens of this species in the collection have been taken as follows.

FUNDATRIX.

Manitou, Colo.,	6-25-13	Populus angustifolia	C. P. Gillette
Colorado Springs, Colo.	6-25-13	" "	C. P. Gillette

FUNDATRIGENIA

Horsetooth Mountain	8-8-09	Populus angustifolia	M. A. Palmer
Spreckles, Cal.	7-27-13	" fremontei (?)	A. C. Maxson
Fort Collins, Colo.	8-11-12	" angustifolia	L. C. Bragg
Fort Collins, Colo.	8-11-13	" "	" " "
Vanderbilt, Mich		" candicans	R. L. Pettit
Boulder, Colo.	8-14-12	"	L. C. Bragg
Sacramento, Cal.	8-1-13	" fremontei	E. Bethel
Horsetooth Mountain	7-19-09	" angustifolia	M. A. Palmer
Boulder, Colo.	8-25-12	" "	L. C. Bragg
Manitou, Colo.	8-9-13	" "	C. P. Gillette
Boulder, Colo.	8-31-13	" "	L. C. Bragg
Manitou, Colo.	10-18-13	" "	G. M. List

SEXUPARA.

Manitou, Colo.	8-9-13	Populus angustifolia	C. P. Gillette
Manitou, Colo.	10-20-08	" "	" " "
Big Thompson Canon	9-18-10	" "	" " "
Boulder, Colo.	8-31-13	" "	L. C. Bragg
Manitou, Colo.	10-18-13	" "	George M. List

SEXUALES.

Manitou, Colo.	10-18-13	Populus angustifolia	George M. List.

Cornaphis, New Genus.

The genus is closely related to *Asiphum* Koch. The wax plates are absent in the fundatrix but are present in the apterous fundatrigenia; the antenna of fundatrix, 5-jointed; of fundatrigenia, 6-jointed; permanent sensoria ciliated. In the type specimens the cubitus is simple, and the fundatrix, fundatrigenia and sexupara all develop in a gall together.

Cornaphis populi, New Species.

Producing galls on leaves of *Populus angustifolia,* which are merely a thickened and extended portion of the margin of the leaf which folds upon the upper surface producing a moon shaped, pod-like gall of a paler green color than the surrounding foliage, and often streaked with red. Galls usually measure from 15 to 18 mm. in length, and are about one-third as thick as the extreme length (figures 11 and 12).

I have never seen more than one of these galls on a single leaf, apparently each gall develops three generations of lice within it, the fundatrix and the fundatrigenia which are apterous, and the sexupara which is alate.

On July 15, 1913, the alate form was just beginning to acquire wings about Laramie, Wyoming. At this time, the fundatrix was still in the galls in a vigorous and active condition.

Description of Fundatrix, Figure 13.

The general color is a slatey gray, the body being covered everywhere with a fine, white powder; the head, four spots in a transverse row on the pro-thorax, the antennæ and legs, including coxæ, black; beak attaining third coxæ; joint 2 of the antenna (figure 15) about three-fourths as long as joint 3; entire antenna, .40 long; apparently no gland plates on any part of the body; permanent sensoria surrounded with ciliary fringe; length of body 2.75. On the vertex, between the insertions of the antennae, is a slight tubercle, which is not very prominent in the fundatrix.

Fundatrigenia, Figure 14.

Apparently the young of the Fundatrix are all apterous, and their offspring, the third generation, all alate sexupara. The other possibility would be for the stem mother to give birth to two sets of offspring, the earlier ones being apterous individuals which later give birth to the sexupara, and the later ones developing into sexupara directly, which does not seem at all probable.

The adult apterous fundatrigenia is of a light straw yellow color and more or less covered with white powder, but there seem to be no tufts or patches of the waxy secretion upon the body; head including a prominent frontal spine, eyes and tarsi blackish; dorsum of head, usually four patches on the pronotum in a transverse line, legs and antennæ dusky brown; beak attaining third coxæ; antennæ (figure 16) 6-jointed; third joint longest but barely exceeding joint six with the spur; joint 4 shortest, being about half as long as 3; length of body 2.50; antenna, .62. This form lives in the gall with the stem female and other descendants of the year.

Described from specimens taken at Laramie, Wyoming, July 15, 1913.

Sexupara.

General color, pale greenish yellow, with dusky head, antennæ and tarsi; thorax a little darker than the abdomen, length 2 to 2.25; length of wing 2.75; length of antennæ (figure 17) .90; median ocellus on a rather prominent tubercle, cauda broadly oval; joints of antenna about as follows: third joint longest, a little shorter than 4 and 5 together; joint 4 a little shorter than 5; joint 6 without spur equal to joint 5; sensoria very indistinct; about 3 to 5 broadly oval sensoria on the distal one-third of joint 3, one near the distal end of joint 4, and also the permanent sensoria on joints 5 and 6; cilia about permanent sensoria rather weak, but always present. The examples studied seem each to be able to give birth to about twelve of the sexuales.